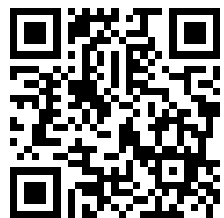
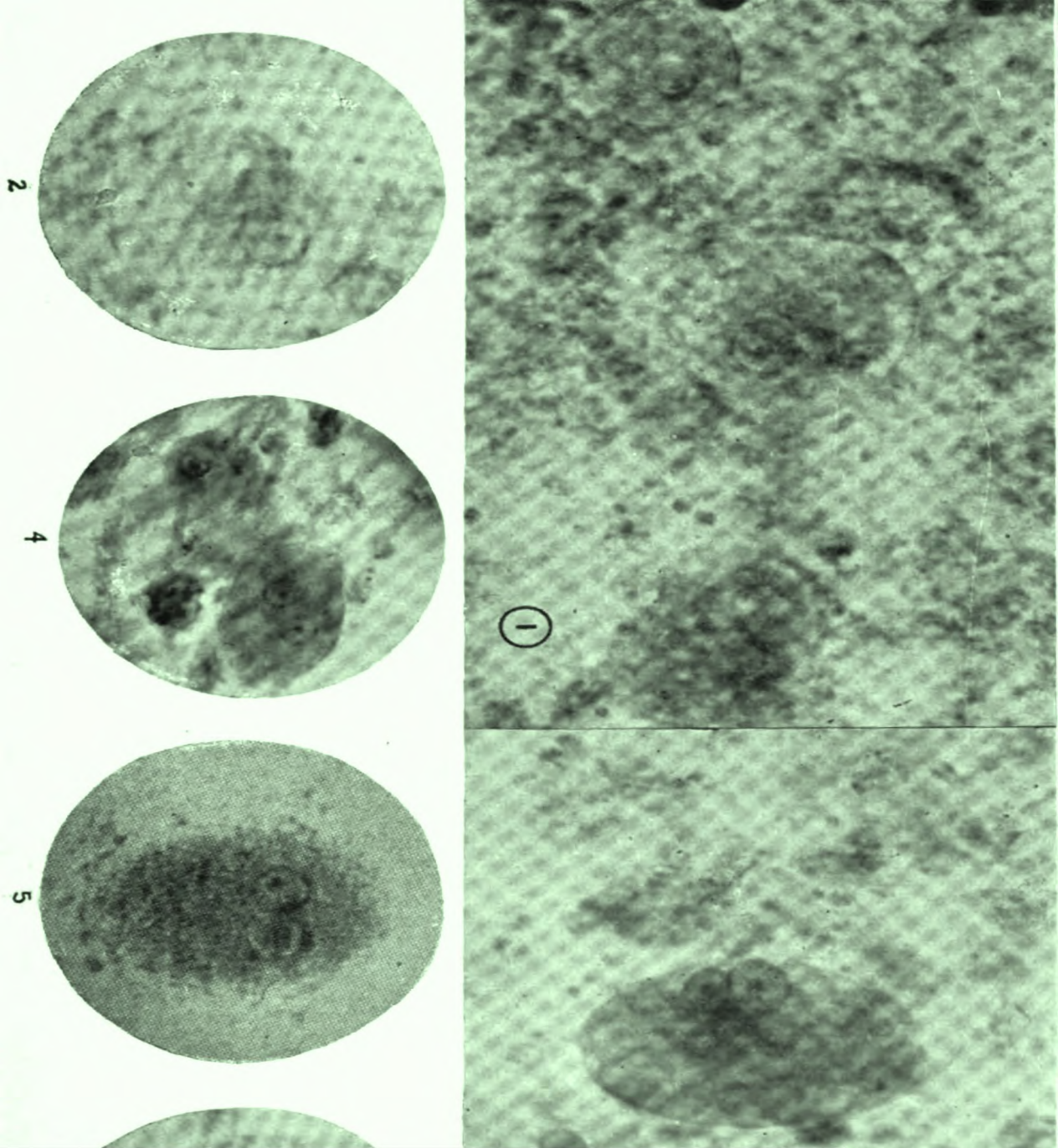

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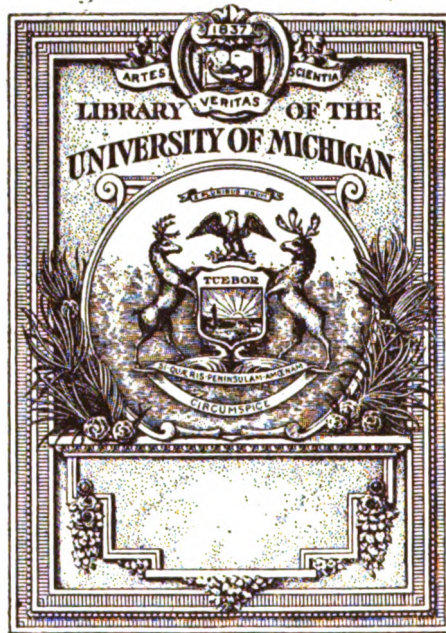
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CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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THE AMERICAN JOURNAL OF TROPICAL DISEASES AND PREVENTIVE MEDICINE

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VOL. II.

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NO. I.

EDITORIAL

Contagiousness of Leprosy. Why Not Blot Out Leprosy?

In *Sanidad y Beneficencia*, of Havana, Vol. X, Nos. 5 and 6, there is a brief but very interesting article by Dr. Jaime Gonzalez Castellano, reproduced from a Spanish contemporary *Revista de Higiene y de Tuberculosis*, of Valencia, on the contagiousness of leprosy. He asks, in his title, the question: "Is the terror inspired by the leper justified?" In his development of the subject, Dr. Castellano inclines strongly to the belief that the danger has been greatly exaggerated, and that, with modern care and cleanliness, the danger is practically *nil*.

From the remotest times, leprosy has been looked upon as the symbol of all horror and suffering; and the belief in its excessive contagiousness has always shaped the rigorous, and even cruel, measures employed against the leper in order to

prevent the spread of the contagion. The Hebrew lawgiver commanded, in the name of God, that all lepers should be driven out of the towns and cities, with their garments rent, the head uncovered, and crying aloud, "Unclean! unclean!" at the approach of strangers.

In the Middle Ages, the leper was regarded as a being who possessed something of the divine, *res sacra miser* raised to the supernatural level of Christian beliefs. In spite of this, the leper was condemned to a kind of civil death from the moment the priest pronounced the sentence of separation or expulsion. He could neither inherit or bequeath property; his relations divided his goods; he was blotted out from the list of the living, and, after having been forcibly torn from his family, he was confined in a leprosy until a slow death put an end to his sufferings, with the sole conclusion that he could return to the bosom of God, as the only reward for his troubles.

Since the history of leprosy has entered on a truly scientific period, and since it has been shown that known leprosy contagion is infrequent, the harsh measures of social prophylaxis of former times should be replaced by gentler ones, and such as are in harmony with science and Christian charity.

Science, with unremitting zeal, endeavors to clear away the confusion that has gathered around leprosy; charity, for its part, strives to put into practice the discoveries of the former; and the two, acting in partnership, have succeeded in mitigating the lot of the unfortunate leper. Still, the old-time fear that the poor creature inspires in those around him prevents him from being treated with as much consideration as other patients who are afflicted with diseases that are more dangerous because of their greater contagiousness.

The extreme contagiousness of leprosy, ascribed to it by Moses and those that wrote on leprosy after him, is due to the fact that, until the sixteenth century, syphilis and many re-

bellious dermatoses were called leprosy, and that the contagiousness ascribed to leprosy was really that of venereal or parasitic diseases.

In time leprosy came to be looked upon as a relic of history, a thing devoid of contemporaneous interest, since the seventeenth century. The death of Father Damien, in 1889, among a colony of lepers, showed that the disease was far from being an extinct morbid entity.

Dr. Castellano says that we should not wonder at the ignorance on the subject that exists among the laity; for, when in 1878 a royal decree was issued in Spain prescribing regulations for preventing the spread of leprosy, many physicians were not aware that the terrible disease existed in the Iberian peninsula, and lepers were admitted to general hospitals like patients suffering from syphilides or other chronic dermatoses.

The horror aroused by lepers is greater now than it was in the Middle Ages. In those ages of faith and love, leproseries were established in large towns or their environs, and nobody thought of opposing such an arrangement. Moreover, the faithful of all classes took pleasure in ministering to the lepers, whom they regarded as the chosen of God.

Nowadays, from the moment a leper learns of his affliction, he endeavors to hide his misfortune from the eyes of his family and his neighbors, and he desires to live apart in order to prevent contagion. If the leper belongs to a family in good circumstances, and in a country in which there are but few cases of leprosy, Dr. Castellano thinks it is safe to isolate the patient in his own home under the inspection of the sanitary authorities; if the patient be poor, it is safer to send him to a suitable hospital, or leproseries. This practice obtains at present in the Scandinavian peninsula.

Whilst leprosy is one of the most venerable of all diseases, it is far from being a negligible quantity in these latter days,

in spite of our boasted progress in the cure and prevention of many ailments. Leprosy has always existed most abundantly in the Orient, but at one time every European country had its "lazaretto," or leproseries. It was looked upon with a mild tolerance for a long time, but the constant spread of the disease forced the people into segregating the lepers; and this course bore good fruit in a few generations, for the disease became practically extinct in most of the countries, and the leproseries were abolished.

The Crusades were especially active in promoting the spread of leprosy, for the returning soldiers of the Cross brought back home the infecting organism and, possibly, the carriers of infection. The great religious orders and the rulers of the afflicted countries established many leproseries, and thus provided one factor in the problem of extinguishing leprosy: segregation. Another, or the other, factor was provided by the advent of improved personal and general hygiene. This was made possible by the cessation of devastating wars, which gave the common people a chance to improve their general condition by devoting more time to the arts of peace.

Many persons in new countries, or in those countries in which leprosy has only a historic interest, fondly imagine that the disease is as extinct as the dodo. In the course of a lecture, Dr. Isadore Dyer of New Orleans stated that there are now probably between two and three million lepers in the world—which is certainly a good showing for an "almost extinct" disease. Before the Crusade, leprosy probably existed in every European country; but those vast military expeditions to the home of leprosy gave a sudden and vigorous impetus to the Oriental invader, which required centuries of vigilance to overcome. The experience of Europe shows two things: first, that, under favorable conditions, leprosy can spread alarmingly and do fearful damage; second, that it can be controlled, and

even blotted out in favored localities—such, for instance, as those that have intelligence and enterprise enough to adopt adequate measures.

What man has done, man can do. If European nations, with the dim lights of science of the Middle Ages, could succeed in making leprosy a subject of purely academic interest, why cannot we, with our vast stores of varied medical knowledge, do as well as our benighted medieval forebears? As a matter of fact, we can, and we do wherever our influence extends, and wherever attention has been drawn to the subject. As a nation, we have established, or enlarged, the leproseries in Hawaii and the Philippines, and in our own State of Louisiana we have an institution for the care of lepers which reflects great credit on the people of our commonwealth.

In considering the problem of blotting leprosy from off the face of the earth we might as well put aside, for the present, at least, all hope of accomplishing this result simply by therapeutic measures. It is happily true that some cases do really get well under treatment; but these fortunate ones are all more or less recent cases with enough of vital resistance left, and the therapeutic measures are invariably accompanied by improved hygiene, without which no case ever gets well. Even if we could imagine all existing cases to be suddenly eliminated, that would by no means assure us of a permanent stamping-out of the disease, for the bacilli that are outside of the bodies of patients—in rags, clothing, houses and insects—would still be capable of starting a fresh crop of cases.

Where, then, does the *Bacillus leprae* lurk by preference? and how can we reach it most effectively? It is precisely at such a point that effective measures have been directed against other communicable diseases, that is, at the intermediate host or carrier, which is the weakest and most accessible link in the chain

of morbid phenomena. That fact was known in a general way to sanitarians even in the earliest ages; modern science has only given precision to what was formerly known vaguely. Thus, it was long known that a newly arrived traveler in Vera Cruz could easily escape yellow fever by immediately traveling by rail to Orizaba, to which place any number of cases of yellow fever could be taken without fear of spreading the disease. That fact was known for a long time, but the reason of it was not known until Carlos Finlay showed the agency of the mosquito in propagating yellow fever, and there are no mosquitoes in Orizaba. Similarly, though in a slower manner, the leprosy chain was broken in the Middle Ages by segregation. There were no cures, but existing cases died at a distance from healthy people, and the bacilli that were left behind by the victims underwent autolysis, so that no infective material was left in old foci of infection. With no personal contact of healthy persons, and no more bacilli left in certain localities to carry on the dreaded disease, leprosy necessarily became extinct in spots. We wish to call attention to the fact that the disease was not transmitted by mere personal contact, such as occurs in ordinary social intercourse, but there was another factor, which was recognized in a general way, and it is this very factor that we are at present endeavoring to track to its lair. This factor is very forcibly brought out, in our opinion, by a little statement contained in the official report of the British Colonial Office on leprosy. Among the cases reported there were four who claimed that they contracted leprosy by sleeping one night in beds occupied by lepers.

For years we have thought it possible that a carrier of leprosy infection, though not a true intermediate host, would be found in some familiar insect, namely, the bedbug. The *Cimex lectularius* accompanies man in all his wanderings, particularly in warm climates. He is not at all fastidious in his choice of

diet, for any kind of animal filth is his meat. Rags and bedding with pus and blood on them are his special delight. Tuberculous sputum also appeals strongly to him, and this may serve to explain why the house of a consumptive is always a source of danger. It is not fantastic to assume that the bedbug can carry the infection of leprosy, for Goodhue has actually found the leprous bacilli in the stomachs of these insects out in Molokai, and Allen J. Smith, of the University of Pennsylvania, has demonstrated that bedbugs may be infected with the *B. leprae* from the human subject.

It is this very point that we wish to bring out. In all ages and in all climes, wherever leprosy has existed, there we find conditions that were favorable to the growth of the lowly and malodorous bedbug; and, further, that fresh recruits to the ranks of lepers were only made when they came in contact with insects that had for a long time enjoyed ample opportunities to become infected. Carrasquilla, of Bogota, Colombia, says that the infection is carried by vermin. The aerial mode of propagation, by way of the nasal passages, is not nearly so direct and definite as the puncture of a blood-sucking insect loaded with the bacilli of leprosy. When communicable diseases are experimentally transmitted to animals, a hypodermic needle is generally used for purposes of inoculation. Nature has armed many insects with a miniature hypodermic needle, and this miniature structure plays an indispensable part in making vast regions practically uninhabitable for man. The recognition of the essential role of these blood-sucking insects and their destruction are essential to colonization of the Tropics. Tropical medicine is the latest great development of medical science. Its achievements are already many and great. Leprosy presents a problem which is akin to those dealt with in tropical medicine, even though it be not confined to the Tropics. We have here a lingering, persistent affliction that seems to bid defiance to

medical science. There are present the common factors of communicable diseases: an infected person and a carrier of infection. The infected ones can only be put carefully to one side, with all the comforts that humanity may prescribe; but the carrier can, and should be, attacked whenever he offers opportunity. We cannot attack a suppositious aerial carrier otherwise than by removing victims of the disease to a safe distance—that is, segregation. But, manifestly, something more than segregation is required, and it is that “something more” that we make bold to bring to the attention of health authorities and all those charged with the care of lepers. This recommendation that we urge in this matter is an active, aggressive campaign, by educational methods and the work of sanitary officials, having for its object the extermination of the *Cimex lectularius*. This may well strike the casual reader as a wild, extravagant dream, born of optimism and a lack of familiarity with the disease. In answer, it may be said that every physician is, or should be, an optimist, otherwise he is not able to inspire hope in his patients, and not fit to practice his art; and our knowledge of leprosy has not been altogether gleaned from books.

The late Dr. Walter Wyman, U. S. P. H. S., always had before him the hope of destroying certain disease germs, and, in this way, of blotting out the corresponding disease. The task of exterminating bedbugs, while a colossal one, is not any greater than some sanitary work that has already been achieved. A campaign of education could be inaugurated that would bear abundant fruit in the course of one generation. We may take hope from campaigns already waged against certain insect pests. We may cite, among others, the yellow fever mosquito, the malarial mosquito, the housefly, the stable fly, and the tse-tse fly in Africa. At first people laughed at the idea of controlling the housefly; but a constant war was carried on, in the shape of pamphlets and other literature, removing breeding grounds, and

even interesting thousands of school children in "fly swatting." This last piece of missionary work not only produces immediate results, but it goes further and educates our future men and women in active home sanitation, and familiarizes a whole generation with the dangers that lurk in some supposedly innocuous objects. With this as a basis, the work of the sanitarian of the future should bear abundant fruit, since he will have the hearty coöperation of a trained body of men and women.

This educational work receives impetus and direction from the apt designations that have been given to certain pestilential insects; thus, we read of the "malarial mosquito" and the "typhoid fly"—these names serve to concentrate attention on the principal infections carried by the incriminated insects. We take the liberty of adding a name to this list of epithets, namely, the "leprous bedbug." The people have entered enthusiastically on a "fly-swatting" campaign largely because the harmless looking *Musca domestica* was correctly characterized as the "typhoid carrier." This does not exclude other modes of infection, but it does serve to fasten a fair share of the blame for typhoid fever where it belongs—that is, on the fly. Similarly, when the people all over Louisiana, and in every other leper-afflicted region, become aware of the dangers that lie in the "leprous bedbug," they will increase their efforts to exterminate this pest as soon as possible.

Louisiana now has probably about four hundred lepers, and less than one-fifth are segregated in the Lepers' Home. That would leave over three hundred foci scattered over the State, to bring sorrow to hundreds more of innocent and unsuspecting persons. These latter have some rights that all of us are bound to respect.

Over a hundred years ago, lepers in Louisiana were segregated in the old hospital near New Orleans. In the course of time, no more cases were sent there, and the institution was

closed, and was finally destroyed by fire in 1807. Leprosy was supposed to be extinct in Louisiana. But please bear in mind that Louisiana in those days presented an entirely different aspect from the present one. The population was very scanty and easily supervised. We now have more than a million inhabitants, with possibly more than three hundred sources of leprous infection. We must face an unpleasant situation manfully and not dream vainly as our predecessors did more than a century ago. If the mountain will not go to Mahommed, then Mahommed must go to the mountain. If the lepers will not go to the institution provided by a generous public, then the afore-said generous public, from sheer self-protection, must go to the lepers, in the shape of duly qualified health officers, and all possible measures should be taken to prevent the spread of the disease by setting up on the premises proper fumigation procedures. The coöperation of the family is indispensable, but this will be forthcoming as soon as they understand the ever-present danger and see a demonstration of a simple but efficient means of destroying it.

There is in the present situation an opportunity for Louisiana to exert a favorable influence on all nations afflicted with leprosy. It will take years of intelligent and unremitting effort to demonstrate the value of the courses of conduct outlined above. But those years are going to pass anyhow; and the question that naturally presents itself is this: Will the Board of Health fill these years with useful, humanitarian work that holds out a blessed promise, or will the board repose peacefully and allow the *Cimex lectularius* to infect another batch of four hundred victims? A successful campaign along definite lines will put fresh hope into the hearts of all sanitarians and will make Louisiana a model to be copied by other nations in leprosy work just as she has served in the work of maritime sanitation.

A. McShane.

The Municipal Health Program.—The proper plan of development of health work in this country would be from a well organized and equipped Federal Board of Health, through state boards properly standardized and closely correlated, to county and municipal organizations. It appears, however, that the growth is in the opposite direction, municipal boards, in many places, far surpassing in efficient health work that of the state boards, while the federal board, notwithstanding party pledges, is yet in the uncertainly distant future.

The prime requisite for efficiency in municipal sanitation is periodical stock-taking through the health survey. It is only in this way that shortcomings may be checked up, overlapping and duplication of function prevented and proper recommendations made for future appropriations.

In the majority of cases the survey will reveal defects, besides those of personal inefficiency, in the following vital elements:

1. *The City Charter.*—Most city charters are cumbersome accretions, and especially the health chapter, the first sections having been prepared years previously, and if any attempts at all have been made to keep it up to date, which is unusual, it is through amendments at long intervals. No city should lose the opportunity of having the health section of its charter radically revised under competent advice.

2. *The Sanitary Code* of the average city is as much out of date as the "blue laws," and utterly inadequate for present-day needs. The code usually deals largely with "nuisances," and all but ignores modern ideas of food control, child welfare, etc. There is hardly any city that would not be benefited by a complete rewriting of its sanitary code.

3. *The Administrative Code.*—Just as the people are to be guided by the sanitary code, just so should the health department be bound to efficient service by an administrative code,

clearly setting forth their powers and duties and giving explicit rules for administrative procedure. This code should not only give the rules, but should prescribe penalties for nonfeasance.

4. *A Proper System of Recording and Reporting* is one of the most useful tools of precision in the equipment of the health department. Recording systems have undergone almost as much evolution in recent years as have our ideas of scientific sanitation, and the health organization that would be efficient without "red tape" must keep abreast.

Speed the day when a Federal Board of Health will be advocating persistently these and other innovations.

Wm. H. Deaderick.

ORIGINAL ARTICLES

THE LATE OUTBREAK OF PLAGUE IN HAVANA.*

By

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It has been the subject of rather lively controversy, specially at home, whether the germ of plague was brought into Cuba from Porto Rico, in 1912, or from beyond the seas. Naturally enough, the Spanish authorities contend that it must have been from Porto Rico, and consider very far-fetched what is the consensus of opinion in my country, that it was introduced from the Canary Islands.

Porto Rico being an American possession, the thorough sifting of this question may not be entirely devoid of interest to my readers. To my mind, the evidence weighs so much against the Canary Islands, that after a cursory examination it seems folly to discuss the matter at length, and only a mistaken sense of patriotism can serve as an excuse for insisting to point towards Porto Rico as the source.

We find at the outset that the human cases first met with (no rat plague had been discovered in Havana until recently), occurred within such a short interval in San Juan and Havana (less than a fortnight), that it seems incredible that the two ports were not simultaneously infected; besides this, the Island of Porto Rico is in communication, not only with Havana, but also with other ports of Cuba, where no plague has appeared, and with several ports of the United States equally free, so far as we know, from this scourge. One is therefore logically led to consider what plague-infected ports have trade relations with both Havana and San Juan, and with no other port of Cuba or the United States; and it is following this process of exclusion that we fall at once upon the Canary Islands. Such a verdict would seem a gross injustice if we were to believe

*Read at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held at Boston, Mass., May 29, 30, 1914.

the government's reports inasmuch as, officially, there is not a pest bacillus in those beautiful islands; but we not only have exact knowledge of the existence of bubonic plague there, perfectly reliable information of deaths from the disease, but also official data, reports signed by the Spanish delegate, describing in full an epidemic that reach to more than eighty cases in 1906-1907, causing the death of a considerable number of persons and which was purposely kept from the knowledge of the rest of the world; more even, with a degree of effrontery almost unbelievable, the sanitary officer, Dr. Luis Comenge, in his report, after more than seventy cases had occurred, states that he is "opposed to declaring officially the existence of plague," and in accordance with this he failed to do so until many months after. Moreover, referring to the duties of the medical officer as he understands them and the means he employed against the epidemic, he says: "To implant whatever may be useful with secrecy, activity and prudent energy and to combat the physical and moral damage of the plague infection by all social and scientific means even to the extent of denying its existence." (*La Peste en Santa Cruz de Tenerife*, 1907.)

This method of the Spanish authorities, of hiding the presence of quarantinable diseases in their territory, has been faithfully adhered to in more than one instance, in spite of all international treaties and the great danger it implies to the other nations, in good faith signatories of the same sanitary conference. For example, no one knew the existence of plague in Barcelona, at various periods extending to 1906; it does not appear in any of the reports of the United States Public Health Service; nevertheless, an official communication, directed by Drs. Masaya, Viñas and Grau to the Mayor of Barcelona, under date of July 20, 1906, begins as follows:

"It is more than a year that this city has been maintaining an active and ceaseless struggle against a most dangerous enemy, bubonic plague."

Barcelona is not unimportant, as everyone knows; its commerce and maritime trade rank very high in the Mediterranean and also with reference to South America and the West Indies.

Taking all this into consideration, the merest tyro in sanitary matters will appreciate the fearful possibilities involved in the practice of such methods of deceit. But in my opinion, the worst lies in the fact that such a custom of hiding cases of epidemic diseases is considered by the Spanish authorities as praiseworthy and commendable; this is proven by the following statement in the report mentioned: "The measures to combat epidemics should be adopted with the greatest secrecy, so as to avoid alarming the people and thus causing incalculable damage to industry and commerce." As Dr. Guiteras very aptly expresses it, this method at the time was successful in producing 67 cases of plague, with 23 deaths. Is it hard to believe under such conditions that Barcelona could have well infected the Canary Islands, with which it is in such frequent communication? Or was it inversely? The matter stands for the nations interested to investigate and check, if in their power; I have merely quoted from official documents in our possession.

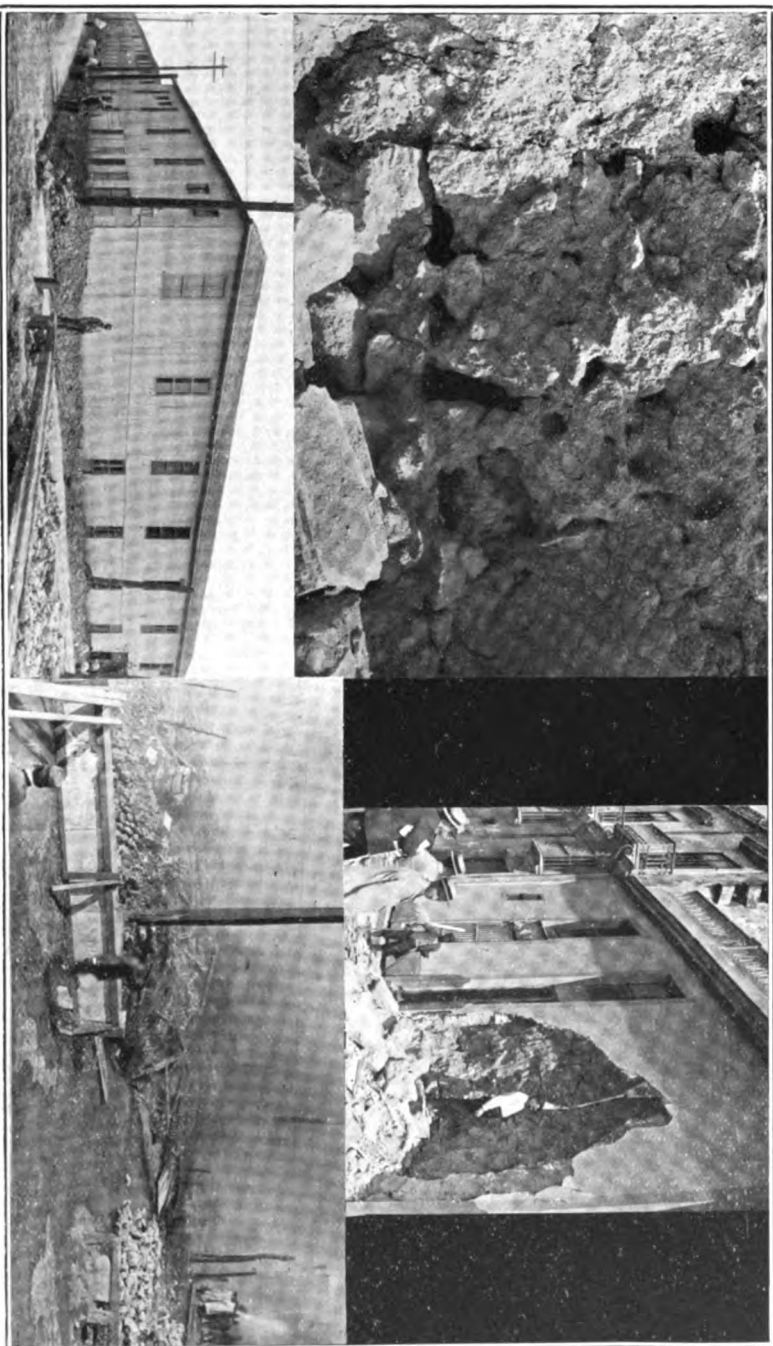
Particularly interesting in this connection, though not exactly referring to plague, is the attitude of the Spanish government during the cholera epidemic of 1911 and 1912; in this instance, it was the systematic hiding of cases that led to panic, causing the spread of cholera in the Catalonian provinces. Thirty-five cases, with 20 deaths, was the record for Villanueva and Geltra, while Barcelona registered 111 cases, with a mortality of 60%. No notice of these cases was given to the world, as is the duty of every civilized country, for the safeguarding of its neighbors, but on the contrary, the existence of cholera in Spain was repeatedly and officially denied. Only a few months afterwards, a pamphlet appeared with a preface by the Governor of the province, in which he states, regarding the method of secrecy, that "the Governor and other authorities have done nothing in the matter but to comply with the most elementary duty of prudence, denying the presence of an epidemic which never existed, and although cases were registered, it was necessary not to alarm public opinion, when only benefit could be derived and has been derived by the conduct of the authorities." It is needless to dwell further upon this matter to show that we may not expect a frank avowal of the real

sanitary situation; also no further proof is necessary, I believe, to warrant the assumption that Cuba and Porto Rico were infected with plague through their trade with the Canary Islands.

* * * * *

With regard to our outbreak in the summer of 1912, little need be said here; it amounted to 3 cases, 2 of them fatal, and never an infected rat found, although about 60,000 rodents were investigated before the work was discontinued. Rumors of an unusual mortality among the rats in a certain neighborhood preceded the first case of plague that we encountered. The last case of that crop developed July 14, dying on the 27th; all of them occurring in the lower part of the city, near the water front, led the sanitary authorities to limit the campaign to well-defined boundaries; the result was the apparent extinction of the infective focus. This notwithstanding, active war against the rat was continued for a year. Unfortunately, it became necessary to suspend this work at the beginning of the present fiscal year (July, 1913), for lack of appropriations, but the sanitary inspection of what had been considered as the infected zone, was maintained in spite of the scarcity of funds. As time passed and no further signs of plague were observed, the authorities became optimistic and hopeful that a thorough stamping out of the infection had been accomplished.

During the period of eight months which intervened, much had been done to improve the sanitary conditions of that part of the city; wooden floors in most of the warehouses had been supplemented by cement or tile; the new sewer system was completed; garbage disposal was being carefully overlooked, etc., when it was reported that a number of dead rats had been found at Oficinas No. 58, a storehouse in the same district, which even then still remained under a cloud. Further search revealed the fact that, indeed, the administration of poison or clubbing had caused the death of quite a few rodents, but the most painstaking investigation failed to show a single plague-infected rat. The house continued under surveillance, however, as well as the men who worked there.



ILLUSTRATING ARTICLE OF DR. AGRANONTE

- Right Upper—Accidentally broken down wall (Acosta St., Havana), showing undermining by rats and poor construction.
 Left Upper—Detail of broken down wall, showing interconnection of rat burrows.
 Left Lower—Old stable of Dept. Pub. Works, origin of five cases of plague, from which it extended to around Tacón Market.
 Right Lower—Same after its intentional destruction by fire (Sanitary Campaign against Plague, Havana, April, 1914).

Before going on to narrate the circumstances attending the appearance of the several cases, their evident sources of infection and the means employed to restrain the spread of the disease, I may be allowed to say a few words regarding two factors in our sanitary administration, entirely unlike any existing in public health organizations elsewhere; I refer to our Board of Infectious Diseases and to the Spanish beneficent societies established in Havana, with branches in all the provinces.

The Board of Infectious Diseases is a consulting body of five physicians, originally appointed during the first American occupation of Cuba, composed of yellow fever experts. Its duties were then mainly to diagnose all cases suspected of being yellow fever. When this disease was finally stamped out in Cuba, the board's sphere of action was extended, the personnel was slightly altered, so that at present three of the members have had laboratory training, and while it continued to look for yellow fever, cases of leprosy, smallpox and all quarantinable diseases are referred to it for final verdict. The board meets at the bedside of every case submitted, thoroughly studies it from the clinical standpoint, collects material for further laboratory investigation if necessary, and either makes diagnosis at once or postpones it until a subsequent visit.

During the late outbreak of plague, the bacteriologic work has been carried out in the Research Laboratory of the Health Department; its findings have been always verified by the board before definite diagnosis was made in every case.

The advantage of having such a permanent corps of specially trained consultants as part of a local sanitary body will be fully appreciated by the medical officer who, more than once, perhaps, may have felt the lack of such support in disputed cases.

The other factor, upon which I desire to remark, is the aid rendered by the Spanish beneficent societies. These large clubs or associations, of which there are five of importance in Havana, have a membership roll of more than 100,000 men. Inasmuch as medical attendance and hospital care, when necessary, are included in the monthly dues of a dollar and a half,

these men promptly apply for professional advice upon the appearance of the first symptoms and seek admission into their magnificently appointed hospitals at the least sign of illness. By exercising a daily inspection of these hospitals, the sanitary department may be said to hold effective supervision over 100,000 of the city's population. And such is the case, for the very same element which supplied the material for yellow fever in former days is the one that has suffered, mainly, from the plague; the young Spanish clerk, employed in the wholesale stores and warehouses of the lower city, overworked, unclean or careless of his person, generally sleeping and eating in the same building where he works, in the midst of dried codfish, jerked meat or hams, or surrounded by bags of corn, rice, beans, peas, strings of onions and garlic, or barrels of potatoes and other foodstuffs. Fortunately, when one of these young men arrive from Spain, the first thing he does, directly or through his employer, is to become a member of one of the societies I have mentioned, which, needless to say, provides entertainment and instruction besides medical care.

These hospitals, located in the outskirts of the city, are modern in construction and equipment, with special wards, laboratories and isolation departments; the staff is drawn from the best medical and surgical talent, their statistics comparing very favorably with those of other similar institutions abroad.

The prompt recognition of cases of plague which applied for treatment at these hospitals, facilitating, by means of their membership records, the tracing of their movements and the source of their infection, has been, in my opinion, a most valuable aid in establishing intelligent action against the spread of the plague infection.

Of course, from an ethical standpoint, these institutions are in no way conducive to the highest standards, since they stimulate and maintain a contract practice in the hands of a limited number of medical men; their power, by virtue of their great financial significance, is such that all efforts on the part of the local medical societies to ameliorate the material damage they cause the profession have met with comparatively poor success.

The first two cases of plague, discovered after the lapse of eight months, were infected close to the water front, within a distance of 500 yards of the focus made evident in July, 1912. These were taken sick on February 24 and March 1 respectively. On March 24, three men became sick in a house (San Ignacio No. 114), further away from the water front. One of these died in 42 hours, bacteriaemia developing very rapidly.

Almost equidistant between the two foci last mentioned, a new one was discovered on April 9, which caused four cases (Inquisitor Nos. 10 and 12), one of them fatal.

The other focus of infection, removed from all those cited by a distance of nearly two miles, was discovered late in April, from which five well-authenticated cases resulted. This was a very large, dilapidated stable, belonging to the Department of Public Works, where all the garbage and refuse wagons were kept; more than 1200 men of the street cleaning service had connection with or visited this veritable "plague spot," and had it not been promptly burnt down, there is no doubt but that many cases more would have been produced there. Quickly as the radical measure was applied, it was not too soon to prevent the infection of the largest public market, evidently through the medium of the refuse and garbage collectors.

The occurrence of plague in Cuba has been limited to the City of Havana, with one exception (Case XII), whose exact source of infection has not been positively established. This was a young man, clerk in a small grocery store, in the town of Artemisa, 45 miles from the capital. No other cases have occurred there in spite of the fact that conditions were not very encouraging for an effective disinfection, hence it may be said that the infection has been restricted to Havana, starting from the water front, in close proximity to the wooden piers, where sailing vessels with onions, potatoes and other produce from the Canary Islands usually docked, each one remaining there for weeks at a time; that the rats on land, once infected, died and were collected with the garbage from each house, by the street-cleaning squad; that the rat fleas, remaining in the wagons or otherwise being carried to the stable, subsequently infected the rodents which there abounded in great numbers.

It is only thus that we can explain the lapse or jump of the infection from the lower part of the city to the remote site of the Public Works stable; further, it is not difficult to establish relation between this focus and the Tacon Market referred to above.

Without entering upon consideration of details, I may be allowed to briefly outline the measures implanted against the spread of the disease.

I must say, at the outset, that although for the purposes of the official records the diagnosis made by the Board of Infectious Diseases is the one taken into account, the sanitary action of the department has commenced so soon as a case was thought very suspicious; thus upon one or two occasions, a negative diagnosis was rendered, after the supposed focus had been disinfecting.

We have been specially fortunate in securing the coöperation of the people, in spite of adverse criticism on the part of a Spanish newspaper which, not stopping at anything, ridiculous as it may seem, went to the extent of questioning the existence of plague in our city; all orders, such as forbidding employees to lodge and board in the warehouses, the ratproofing of floors and walls, the frequent sprinkling with disinfectant phenol solutions, as well as the enforcement of rules for the disposal of garbage, etc., were promptly complied with; the water front and shipping also received instructions and were compelled to observe such measures as prevented the interchange of rats with the shore, and worked against their prospering and multiplying.

The medical profession, on the other hand, rendered valuable aid by the immediate reporting of cases, while at the Spanish hospitals every facility for safe observation and investigation was afforded.

All over the lower part of the city an extensive campaign of rat trapping and poisoning is still carried on with unceasing energy, at the same time that a bonus of five cents per rat is paid by the government to private, enthusiastic rat catchers.

Contrary to Spanish custom, we have taken care to supply the press with complete and truthful information as to the oc-

currence of cases, their significance and importance from the standpoint of their danger to the community, and severe punishment was imposed upon those who in any way hampered the action of the authorities or hid suspicious cases. This was considered a grave offense; in one instance, at least, we feel sure that the man's death might have been prevented by prompt report of his illness; instead, it was kept secret until he was sent to the hospital in a dying condition (Case XVI).

Sometimes it is practically impossible to make a positive diagnosis when the patient is seen for the first time; then, it becomes necessary to resort to laboratory methods of research. Juice from the enlarged lymph nodes is planted in suitable media and rubbed into guinea pigs. But these tests require time, the cultures at least three days and the animal inoculations certainly not less than six, besides the obviously attendant danger from accidents, etc. At other times, there may be a difference of opinion, with good reason, perhaps, amongst those called upon for diagnosis, so that any test that could be applied at the early stages of the disease would, indeed, be very welcome. Has fixation or deviation of the complement been attempted elsewhere?

As I have said before, the authorities in Havana always acted immediately a case was considered sufficiently suspicious by the board to postpone the diagnosis.

The direct methods usually employed in treating infected buildings was to make it smoke tight, as well as the adjoining houses; then sulphur in the proportion of 4 to 5 pounds per 1,000 cubic feet was burned, lighting first the adjoining and then the infected house; this was intended to prevent the emigration of rodents from the infected premises into the neighboring buildings. The floors were always previously wet with strong solutions of hyco, chloro-naphtholeum, etc., or thoroughly flooded whenever possible. All rat holes were then immediately sealed by means of concrete and the other houses of the block were in turn treated the same way. After fumigation, guinea pigs were introduced to serve as tests; in several instances they were the means of detecting the presence of in-

fected fleas, becoming themselves infected with plague, where it was not expected that they would.

It soon became evident that the proper disinfection of premises could not be carried out while the people remained about their houses or anxiously awaited the moment to return to them, and so the authorities decided upon the temporary depopulation of a large section of the city, embracing seventeen blocks, which was declared as an infected zone; the people were ordered out, and went, within twenty-four hours, carrying with them but a small bundle of clean clothing for each person; those unable to obtain or pay for lodging elsewhere were given accommodation at the Immigrant Station across the bay, where they were very well attended during the time necessary to disinfect the district. This was placed under military control. About 200 persons took advantage of the opportunity and enjoyed a vacation of three weeks at the government's expense. Everyone returned home at the expiration of this time, with the exception of those who lived in houses which had been demonstrated as infected, these being subjected to further treatment.

The old ramshackle stable belonging to the Department of Public Works, above referred to, occupied an entire block, near the bay, but a considerable distance from the known foci of infection; when cases from there began to appear, almost simultaneously, and it became evident that conditions for its fumigation were absolutely unfavorable, it was decided to burn it down. In order to prevent the escape of rats, a ditch about a yard wide and as much in depth, was dug surrounding the block; it was filled with water on which a sufficient quantity of oil was floated, with the object that it would take fire at the same time as the buildings.

The place had been overrun with rats and all kinds of vermin, as a great quantity of forage was always kept there. The night before the intentional conflagration, a plague-infected rat was found dead, by one of the sanitary department employees. Nothing but the animals, wagons, tools and harness was allowed to be removed before the fire, having been previously disinfected with phenol solutions. All of the forage, the old wagons, carriages and the buildings themselves, were

sprinkled over with oil to insure and hasten their combustion. Such was the freedom enjoyed by rats in the old stable that, the night after the fire, dozens were caught of those which came from the neighborhood to feed upon the forage that was usually distributed to the animals at dawn. A public park will occupy the site of this former pest hole.

Very early in the campaign it was realized that sulphur fumigation was not doing what had been expected of it, in the way of thoroughly disinfecting the buildings where it had been applied. On April 11, a guinea pig was infected with plague at 116 San Ignacio street, which had just been fumigated, next door to a house (No. 114) that had produced three cases of plague, one of them fatal. Subsequently, from three other houses, guinea pigs have contracted plague, after having been fumigated with sulphur. The matter was of the utmost importance, for at no time could we admit that the plague bacillus could be specially resistant to this agent and it became urgent to find the explanation and to remedy the defect wherever found.

Sulphurous acid in the proportion used in Havana certainly kills insects as well as bacteria, but its penetrating power into the rat burrows must of necessity be somewhat limited; in fact, when rat holes have been left unsealed, it has been possible to trap rats in the same building, after fumigation, showing that these rodents were sufficiently far inside their burrows to escape the death-dealing fumes; as far as Havana is concerned, we can easily understand this contingency after witnessing the condition of some houses upon the occasion of the partial tumbling down of a wall in the so-called infected zone. It happened after a severe rainstorm, and although the wall cracked in various directions, only the external layer fell out, revealing a most discouraging state of things; for an extent above two yards in height, the wall, originally of stone and poor mortar, about thirty inches in thickness, was thoroughly honeycombed by rats; several of them were seen to escape at the time of the accident. In the face of such evidence one can readily appreciate the causes of failure and how rodents may hide in the remote recesses of their maze-like chambers, inac-

cessible to the sulphur fumes not under pressure; further, the irritating quality of this agent, even in small quantity, gives warning and allows time for the animals to try to escape; no doubt many are killed and, indeed, quite a number are surprised before they get to their holes and are found dead upon opening the houses, but perhaps it is the very ones we wish to kill that escape us, from the very fact that the sick rat, the plague-infected one, is more liable to remain in its burrow and when it dies will pass on all its infected fleas to the others that may travel along their interconnecting runways.

A more reliable muricide and insecticide is certainly hydrocyanic acid gas, which has been employed whenever the sulphur fumes have been thought unsuccessful. It is obtained by the action of dilute sulphuric acid upon cyanide of potash, the latter drug being used in the proportion of 10 to 15 grammes for every 10 cubic meters of space. The disinfectant action of prussic acid gas, so far as the specific organism is concerned, of course cannot be sustained, but in plague disinfection what we want to kill is the rat and its concomitant fleas, the pest bacillus being of secondary consideration, though its destruction is most imperative. Everything seems to indicate that in hydrocyanic acid gas we have all that is necessary. It is a treacherous substance, inasmuch as the odor is not objectionable to the rodents, so that they don't run away, even if they had time to do so; in fact, death by this means comes to all living things with remarkable suddenness and apparently without warning. Test fleas, spiders, cockroaches, etc., were placed in imperfectly covered tubes, inside the houses treated by this method of disinfection, and at no time were the insects enabled to survive. The danger entailed in carrying out the operation, which I am afraid has been somewhat exaggerated, was always carefully considered and with proper precautions all accidents were fortunately avoided.

The employment of prussic acid gas has been particularly successful in tobacco warehouses; evidently in no way is it injurious to the "weed," nor does it affect its aroma; in one instance, bales of tobacco being open and the leaf spread about, no deleterious effect could be detected after fumigation.

So far, the chief objection to the use of hydrocyanic acid gas, besides its possible danger to the operators, are its expense and its rapid diffusion (otherwise a most valuable quality), which demands a more careful and therefore dilatory preparation of the building in order to make it gas tight.

* * * * *

The cases presented in the accompanying table have been most instructive in many ways: at first glance we see that no women have been infected, the disease having attacked only men (three boys, Cases III, VII and XIX), in the majority Spaniards.

Case XVII was a boy with *pestis minor*; he apparently never had fever and outside of the bubo which developed, causing some pain until it was incised, he felt no discomfort whatever. Case III was exactly the opposite; his temperature rose rapidly, a semi-comatose condition supervened, and in less than 24 hours, *Bacillus pestis* could be demonstrated in his blood, death taking place 42 hours after the onset of the disease.

Another salient character in our cases has been the prevalence of inguinal or subinguinal and crural buboes, only once occurring in the axilla; this probably shows that the patients were infected at their work, hence always through the lower extremities, which would not have been the rule if the infection had been acquired while in bed, during sleep, when fleas are as apt to bite the legs as any other part of the body.

The lack of symptoms in the early cases, besides the complete and uninterrupted recovery of the first one, without specific treatment, led us to think—the wish was father to the thought, perhaps—that possibly the pest virus which had come upon us had suffered a marked degree of attenuation, such a one as we frequently see in the laboratory cultures of the bacillus; but the subsequent cases showed unmistakably that in our infections at least, the benignity, in most instances, was due entirely to personal conditions peculiar to the infected individual and as an excellent example of this, a veritable object lesson, we had Cases III, IV and V, taken sick the same day, in the same house, and thus presumably infected by the same strain of bacillus,

if not by the same fleas, who developed three markedly different clinical forms of the disease as regards the intensity, one of them proving fatal.

In my opinion, a mild epidemic or a malignant one of plague, must depend upon other circumstances—personal or of environment—than the degree of virulence of the organism itself. I think, in connection with this, much might be said with regard to the influence of treatment and care at the very earliest stage of the disease. At “Las Animas” Hospital a record of no deaths has been maintained (nine cases treated), in spite of the severe nature of some of the cases; those who received massive doses of anti-pest serum within 48 hours of the onset were seen to react favorably, at once, and although the action of this agent is not as theatrical as we are accustomed to see in diphtheria, a study of the clinical histories of those cases cannot but impress one with the wonderful curative properties it possesses, even in the most intense infections or in individuals, ill-fed, vicious or otherwise, whose physiological integrity was from the beginning far below par.

No more cases of this dread disease have lately appeared, still I must not be understood to presume that we have, at this date, stamped out bubonic plague in Cuba; unfortunately, it must still be lurking amongst the rat population there, and until it be entirely eradicated we may expect human cases; but we shall keep up the fight until, as we have done with yellow fever and smallpox, a clean bill of health is our reward.

I have outlined the actual work that has been done; my country is greatly indebted to the Director and the local health officers (Drs. Guiteras and Lopez del Valle), for the manner it has been carried out. In merely touching upon the problems that we have had to solve, I have intended less to show how it was accomplished, than to call forth criticism and discussion, since the pandemic of plague is knocking upon every door and no country may consider itself absolutely safe.

Written in the hurry attendant upon the performance of many duties, I claim for this paper no special literary or scientific importance, but hope, nevertheless, it may be deemed not entirely unworthy and in accord with the object of this Society.

Cases of Plague in Havana, Cuba, since February 24, 1914.

Case No.	Name.	Nationality	Occupation.	Source of Infection.	Date of Onset.	Situation of Bubo.	Observations.
*I.	Leonardo Muñoz.....	Spain.	Clerk in warehouse.....	Oficio No. 1.....	Feb. 24.	Left supra and subing.	Recovered
*II.	Fr. Fernandez Nuñez.....	Spain.	Clerk in warehouse.....	Oficio No. 58.....	Mar. 1.	Right subingual.....	Recovered
*III.	Carlos Arceba.....	Spain.	Errand boy in warehouse.....	S. Ignacio No. 114.....	Mar. 24.	Left crural.....	Died Mar. 26 (42 hours)
*IV.	Marcelino Figueroa.....	Spain.	Clerk in warehouse.....	S. Ignacio No. 114.....	Mar. 24.	Right crural.....	Recovered
*V.	Antonio Escandon.....	Spain.	Driver for warehouse.....	S. Ignacio No. 114.....	Mar. 24.	Right crural.....	Recovered
*VI.	José Santisteban.....	Spain.	Clerk in warehouse.....	Inquisidor No. 10-12.....	Mar. 9.	Right crural.....	Recovered
*VII.	Victoriano Granda.....	Spain.	Clerk out of work.....	S. Ignacio No. 116.....	Apr. 10.	Left crural.....	Recovered
*VIII.	Marcelino Trueta.....	Spain.	Clerk in warehouse.....	Inquisidor No. 10-12.....	Apr. 11.	Right crural.....	Died Apr. 14
*IX.	Luis A. Con Telefono.....	Spain.	Clerk in warehouse.....	Inquisidor No. 10-12.....	Apr. 11.	Left crural.....	Recovered
X.	Hellodoro Rodelgo.....	Cuba.	Driver, Dept. P. W.....	Stable, D. P. W.....	Apr. 13.	Right supra and subing.	Recovered
*XI.	Ramiro Castro.....	Cuba.	Workman, Dept. P. W.....	Stable, D. P. W.....	Apr. 16.	Right supra and subing.	Recovered
*XII.	Gabriel Prieta.....	Spain.	Clerk, grocery store.....	Town of Artemisa.....	Apr. 20.	Right crural.....	Recovered
XIII.	Miguel Mateo.....	Cuba.	Workman, Dept. P. W.....	Stable, D. P. W.....	Apr. 18.	Right axillary.....	Recovered
XIV.	José Sande.....	Cuba.	Workman, Health Dept.....	Stable, D. P. W.....	Apr. 26.	Right crural.....	Recovered
XV.	Domingo Govin.....	Cuba.	Workman, Dept. P. W.....	Stable, D. P. W.....	Apr. 26.	Right crural.....	Died Apr. 29. (Was kept hidden for 3 days)
*XVI.	Gumersindo Perez.....	Spain.	Clerk in warehouse.....	Baratillo No. 1.....	Apr. 13.	Right crural.....	Recovered (Pestis minor)
*XVII.	Ramon Ruiz.....	Spain.	Clerk in store.....	Inquisidor No. 10-12.....	May 1. (?)	Right supra and subing.	Recovered
XVIII.	Juan Valdes.....	Cuba.	Fruit vendor.....	Tacon Market.....	May 13.	Right crural.....	Recovered
*XIX.	Vincente Revuelta.....	Spain.	Clerk, grocery store.....	Tacon Market.....	May 13.	Right crural.....	Recovered

*These cases were seen at Spanish societies' hospitals.

THE OPPORTUNITIES AND NEEDS OF THE AMERICAN STUDENT AND INVESTIGATOR IN TROPICAL MEDICINE.*

PRESIDENT'S ADDRESS.

By

RICHARD P. STRONG, M. D.,

Professor of Tropical Medicine, Harvard University Medical School.

First, permit me to express my appreciation of the honor which you have conferred upon me of presiding over this assembly, and second, to extend to you a cordial welcome to this institution. Twelve years have elapsed since the establishment of this Society, and while this is but a short time, as history counts time, in which to measure progress, nevertheless, the harvest of successful investigation in relation to tropical medicine and hygiene has been unusually abundant during this period, and indeed in no previous one has such rapid advance been made in relation to this subject. During these twelve years of our existence many workers have been busy trying to find out the nature and cause of tropical diseases, the best method of their elimination and extermination, and their proper treatment. In this we have succeeded, as I have intimated, to a very great degree, and in a number of instances the favorable results obtained have been even more brilliant than those achieved during the same period in connection with the study of the diseases encountered more commonly in temperate climates.

The deadliest terrors of tropical life are being gradually and steadily eliminated, the death rate of whites and natives alike in many tropical regions is being diminished, and the development of their fertile lands rendered possible without the terrible suffering and loss of life which previously resulted from it. Moreover, the hindrance to commerce and to colonization caused by ignorance of the means of combating tropical disease

*Read at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held at Boston, Mass., May 29, 30, 31, 1914.

is slowly but surely becoming appreciated by the laymen in general and particularly by business men.

The American Society of Tropical Medicine.

Twenty-five years ago we might well have been asked in the words of the philosopher, Henri Bergson, "What are we, whence do we come, and what are we doing here?" The justification of the existence of such a society as this in the United States at that period might have been very properly questioned, and whoever had advanced such a proposition as the organization of one, would doubtless have been considered by the leaders of our profession as a dreamer of dreams. However, history decreed otherwise, and to-day no one questions the existence of such a society in this country or the importance of the functions which it should perform. Indeed, since the occurrence of societies of this nature is largely governed by the demand for them, if there were not an important place for the Society of Tropical Medicine in America it would probably have ceased to exist during this period.

Need for Investigators in Tropical Medicine.

With the territorial expansion of the United States begun in 1898, and with the subsequent acquisition of our government of tropical possessions, both in the Eastern and Western Hemispheres, also with our greatly increased trade relations with, and development of commercial interests in many other tropical and subtropical countries, additional responsibilities arose and new demands were created for an accurate knowledge of the diseases prevailing in these countries and for their prevention, there then became an urgent need—and one which continues to exist—for well-trained men both for the investigation of these problems in the Tropics and for the introduction of proper sanitary measures in these regions in relation to preventive medicine. Up to the present time it has not been possible to supply men always who have been properly fitted for this work or those who are best qualified to carry it on most successfully.

The reasons for this seem obvious: first, sufficiently stimulat-

ing and adequate training in relation to this subject has not been offered in our medical institutions; and secondly, the number of satisfactory candidates has been small. Why does there continue to exist among many investigators and students in medical schools at the present time a lack of interest and an apparent timidity in regard to the study and investigation of tropical diseases?

Opportunities for Investigators in Relation to Tropical Medicine.

To the student who is anxious to explore new fields of original investigation I would say if he casts his eye for a moment over the wide domain of medicine, it cannot fail but at once be arrested by the fields of opportunity offered in tropical medicine. Whithersoever he looks he will find no monotony, for he can see but a small portion of the drama at once, since each tropical region has its own indigenous diseases and the special problems connected with their nature and prevention. In no other department of this subject at the present time are the opportunities for research and advancement so great, perhaps, as in that of tropical medicine, and there is nothing in the history of medicine, with the possible exception of the advances in modern surgery, that can be compared with the extraordinary development in tropical medicine that has taken place in the past twenty-five years. When one considers for a moment that the discovery of the cause of Texas fever, of plague, of bacillary dysentery, of Gambian fever, and sleeping sickness, of kala-azar, of African tick fever, of frambæsia, and of Oroya fever, and of the methods of transmission of Texas fever, malaria, yellow fever, sleeping sickness, African tick fever, plague, and kala-azar, are only some of the discoveries in relation to etiology alone that have taken place during this period, surely the student and investigator should find in this field of work enough to encourage the confident hope of still greater harvests in the future. Indeed, only a beginning has been made, and although much has been done in this field, much more yet remains to be accomplished, and there are still many new vistas

and new possibilities unexplored. The results of the interesting advances which have been cited must enhance our hopes of even more valuable additions to our knowledge of this subject at a date not far distant. In the Tropics one particularly finds many influences unfavorable to health and life, whose method of eradication still awaits discovery for the patient inquirer and observer. Lastly, I would ask of the investigator in tropical medicine what work can better stimulate the energies than pioneer work in an unknown land of which the outcome is uncertain, and where, if you will pardon the variation, experience is particularly fallacious and judgment often perilously difficult; and if he should falter by the way let him recall that investigations of this nature in the end sometimes have been the most fruitful of all. Such pioneer work, involving new problems, new methods of research, trial trips into the unknown, often develops in a short time results of the greatest possible importance. We are still groping in the jungle in the dusky twilight of the dawn after many problems, and we doubt not that the brighter radiance of the tropical day will reveal much that is now hidden from our eyes.

Opportunities in Public Health Work.

To the student interested in public health problems I would say that in scientific sanitation lies the chief hope of successful work for dwellers in tropical climes. While so much has been done in the discovery of the causes of tropical diseases, the most profitable application of these researches obviously lies in the direction of prevention. Need I point to the history of Panama? In 1699, Paterson, Macaulay tells us, the founder of the National Bank of England, conceived the plan of connecting the trade of the Far East with Scotland across the Isthmus of Panama. It was his intention to bring to Scotland untold wealth, and to make her the richest nation in the world, but the scheme failed for the reason that the colony founded by Paterson at Darien, near Panama, which was to supervise the trade relations at the Isthmus, between that point and the Far East, was completely decimated on two occasions by yellow fever and malaria. We feel that we know why the French did

not complete the wonderful task of building the Panama Canal, and why their second attempt resulted, as the first had done, in failure. Although capital was eventually lacking, it was not their engineering that was at fault. It was the repeated destruction of their workmen and the exhaustion of their energies by tropical disease that largely influenced their withdrawal. At that time the methods of transmission of malaria and of yellow fever were not known, and it was to these two diseases that their failure was chiefly attributed. In 1904 we took over the administration of the Canal Zone, and to-day almost everyone knows how Gen. Gorgas and Col. Goethals and their assistants have transformed this region from one of the deadliest spots of the earth to a habitable one where yellow fever now no longer exists, and where malaria is continually held in check in its ravages.

Consider for a moment the results in sanitation that have been obtained in Havana. In this city nearly forty thousand people are said to have perished of yellow fever between 1853 and 1900. In 1900 the United States introduced modern methods of preventive medicine based upon Walter Reed's and his associates' discoveries, and in 1907 only one case of the disease was reported.

As an example of a somewhat different achievement in tropical, preventive hygiene, consider the results of the campaign which has so ably been conducted in the United States against hookworm disease. So successful has this undertaking been that the directors of the movement have felt justified in establishing an International Health Commission which will extend its activities to the extermination of this disease in various parts of the world.

It is certainly unnecessary for me further to point to the tremendous reduction in the mortality and incidence of disease in the Philippine Islands that has been accomplished against cholera, plague, smallpox, and dysentery, and to the successful results that have been obtained in Uganda by the introduction of sanitary measures against sleeping sickness. Can the student of public health work point to greater triumphs in relation to preventive medicine in temperate climates? Unless he be

inclined to consider that the largest opportunities of this nature have gone by in the Tropics, can we not tell him with confidence that the opportunities for such work are only beginning? Need I remind you of India with its annual toll of often a million deaths from plague Guayaquil, with its "million murdering" malaria, yellow fever, plague, dysentery, typhoid fever, and uncinariasis, is only waiting for a sanitary conquest, and think of the goal to be won there in public health work by courageous, intelligent, patient and ceaseless effort.

Opportunities from a Humanitarian Standpoint.

However, it is not given to us all in equal measure to contribute to the advance of etiological knowledge, or to labor in the original field of preventive medicine, and to the clinician with the missionary spirit I would say that in many regions in the Tropics the opportunities from a humanitarian standpoint cannot be equalled. To him who can bear continually in mind that in sickness and disease all flesh are akin, and who will patiently labor in the path of preserving as far as possible every human being, no matter how imperfect his intellectual and physical development, the opportunities are unbounded. As I have said elsewhere, nothing so depresses and so discourages a population as the presence of serious epidemic diseases. Industries not only go to pieces, but the people become saddened, hopeless, and indifferent. No charitable work can be more beautiful than the uplifting of a people through the eradication of disease that is a continuing detriment to their mental and physical condition.

Vicissitudes Attending the Study of Tropical Medicine.

The investigator in tropical medicine, however, must not feel that his path is to be one strewn only with roses. In no other department of medicine will he have greater need to be more keenly alert and to utilize every discovery in other branches of science in his researches, and he may be called upon to undergo vicissitudes of climate and of physical hardship not ordinarily encountered by his fellow-workers in tem-

perate climes. Often is he likely to long for the luxury of his well-equipped laboratory at home, particularly when his investigations carry him into an interior region where his equipment for some reason has not been able to accompany him. Here he may be called upon at some propitious moment to stand or sit for several hours, perhaps exposed to the tropical sun, or again surrounded by annoying insects, with his microscope perched upon a barrel or some other similarly improvised stand, while the humidity from his eyelid continually blurs his field of vision and throws an almost impenetrable veil over the ocular through which he is patiently attempting to record some important observation. Under such and other much more trying vicissitudes which he is likely to encounter, some support may come to him¹ by recalling the thought so ably expressed by Sir William Osler, "It has been said that 'in patience ye shall win your souls,' and what is this patience but an equanimity which enables you to rise superior to the trials of life. Take with you, then, into the struggle the watchword of the good old Roman, Antoninus Pius, '*aequanimitas*.'" "

Advantage of Training in Tropical Medicine to the Physician in General.

Lastly, let me say to the medical student and investigator in general that in my opinion no training will assist him in his understanding of modern scientific medicine, or give him a wider grasp of the subject, than a training in tropical medicine and its allied branches—protozoology, entomology, bacteriology, and helminthology. I say allied branches, for these subjects are very closely linked with and really form the ground work of tropical medicine; they should be taught together, and better opportunities exist in relation to tropical work for the study of all of them.

In regard to positions available, particularly for American physicians well trained in tropical medicine, I would say that in addition to those in our government medical services and the opportunities furnished for the practice of medicine in our

1. "He who follows reason in all things is both tranquil and active at the same time and also cheerful and collected."—*Marcus Aurelius Antoninus*.

tropical dependencies, the Rockefeller International Health Commission can furnish a career to men properly trained in tropical medicine. The United Fruit Company of New York and Boston also has an extensive medical service under the direction of Dr. Robert Swigart, and offers attractive opportunities to young men, while at least one educational institution I know of has vacancies for competent workers in this subject.

Training Necessary in Tropical Medicine.

Having outlined some of the opportunities for advancement for the student and investigator of tropical medicine, let us next turn our attention to his needs. What can we, the state, the medical school, this society, do for him? How can we aid him on his way? The successful worker in tropical medicine should not only be well trained in the laboratory branches of protozoology, helminthology, bacteriology, and entomology, but he should in addition have a careful training in general clinical medicine in order to be able to recognize new clinical conditions in tropical countries. Much confusion in tropical medicine has resulted sometimes through the investigator failing to identify from a clinical standpoint an already recognized disease and regarding it as a new condition, and vice versa, wrongly diagnosing an undetermined affection as an already recognized disease. It is our duty first to provide adequate training for this investigator and to establish courses with proper laboratory facilities in the branches mentioned.

Need for Endowment of a Complete School of Tropical Medicine in America.

I regret to say I feel that until recently, certainly, we have in the United States been very backward in the establishment of proper training in connection with this subject. To obtain proper facilities for clinical study and for the establishment of the laboratories referred to, much money is necessary, and so far this apparently has not been forthcoming for this purpose in any considerable amount. I also regret to say that in my opinion, while the organization has been completed, no ideal

institution for instruction and research work in tropical medicine has yet been established in this country, and only on account of lack of sufficient endowment.

Great Britain at the present time supports two well-known schools of tropical medicine; Germany, France, and several other European countries, each one. It is noteworthy that while all of these schools have been successful, they are all situated in temperate climates and not all of them are located at large seaports. In Great Britain the marked increase in importance of tropical medicine has recently become realized in a substantial way, and much financial support has been given for the advancement of this subject. A short time ago an appeal for funds to be applied to the extension and development of the London School of Tropical Medicine was made. At a meeting held a few days after the appeal Mr. Chamberlain announced that one benefactor had promised to contribute five thousand pounds when the fund reached twenty thousand, and there were ten other donors each of one thousand pounds. Eventually over seventy thousand pounds were obtained by popular subscription to this movement.

In connection with this appeal some of the remarks made by Mr. Chamberlain are significant. He said in part:

We have a special obligation to the young men of our race who go out to other climes, leaving easier and certainly safer paths at home, carrying with them the honor of their country, doing her work, spreading her colonization, and increasing her reputation. Their country owes to them that at least she should do everything possible to minimize the risks they naturally have to run, and should show her appreciation of their work by striving to secure adequate protection through research into the conditions of health and the cause of illness to which their labors render them particularly exposed.

Duty of Commercial Firms with Interests in Tropical Countries.

I have tried to point out that in view of the responsibilities created by the addition of new territories by the United States in recent years, and her greatly increased trade relations with many tropical countries, the importance of tropical medicine also has largely increased in this country. America al-

ready has reason to be proud of many of her achievements in relation to tropical medicine, and no board of directors of a commercial firm with interests in tropical countries can fail to recognize the great financial benefit which it already has derived from the discoveries which have been made in relation to tropical medicine and hygiene. In addition, while we have been trusted by the public and frequently have been called upon to protect the interests of corporations in relation to questions of tropical hygiene, we have not been adequately rewarded. We who can speak with authority know that by intelligent, human effort the mortality from tropical disease can be greatly reduced, and the strength and efficiency of the white man in unhealthy climates sensibly increased. Successful colonization and successful commercial ventures in the Tropics depend before everything on the advance of knowledge of the diseases which are most prevalent in these regions.

In view of all this, and particularly of the benefits already received, it is rather difficult to understand why in this great country of progress and advancement a sufficiently substantial endowment of a proper school of tropical medicine has not been forthcoming. The subject should appeal to all who are interested either in humanity or in commercial projects in the Tropics. In saying this I do not mean to be unappreciative of what has already been done, and of the generous way in which a number of individuals in this country have given assistance and financial support to this movement, but I feel it my duty to-day to emphasize the great necessity, if we are to succeed, of further substantial financial aid in relation to this subject.

Need for Trained Physicians in Connection with the Mexican Situation.

One other point I should like to bring to your attention in connection with the duty of our government, and our duty as citizens, in relation to tropical medicine. Whether we are at present at war with Mexico or whether we are not, it has been found necessary for our army to enter Mexican territory. While we all hope for a peaceful solution of the present grave

situation, it is very possible that our National Guard may also be called upon to undergo a campaign during the coming summer in this country, and those who compose it, unacclimated as they are, will then be exposed to the dangers of the diseases which prevail in Mexico and the adjacent territory. How many of the medical officers who will accompany this body of troops, and how many of the contract doctors that will also be required for our regular army, have had opportunities for study and investigation relating to the cause, prevention, and treatment of yellow fever, plague, typhus, and the other tropical infections which may be encountered in that country, or special knowledge of the many other problems in connection with tropical hygiene which may arise there? Would not the mothers and fathers of those who compose the rank and file of this army feel less anxiety in the realization that their sons at least would be guarded as far as possible against such diseases, and cared for, if they fell sick, by medical officers who had received special and adequate training in a school of tropical medicine? Rest assured if it is necessary for this body of our army to enter and remain for any length of time in Mexico during the hot season, the loss by disease will many times outnumber that by shot and shell.

Need of an American Colonial Medical Service.

This brings me to a final point which really constitutes one of the responsibilities which this society has contracted. In Great Britain the Colonial Office now expects all nominees for the colonial medical service to pass through one or other of the two established schools of tropical medicine of that country before their appointments are confirmed. Commercial firms engaged in tropical enterprise in that country also demand from medical applicants for employment corresponding evidence of special knowledge of tropical medicine. In Germany medical officers undergo a special training at the School of Tropical Hygiene at Hamburg before being selected for employment in the colonies. What special training in tropical medicine are candidates for positions in our government medical services

in our tropical possessions required to undergo? Surprising as it may seem to some of you, the answer is "None whatever." By far the great majority of the candidates who have accepted positions in these services have had no special training of this nature, and when they arrive at their stations it is frequently necessary to send them into the interior where there are no facilities for them to secure the fundamental training in the laboratory branches which they lack. There is no question in my mind but that such candidates should be required to receive instruction in these and other branches of the subject before being accepted and appointed to positions in our tropical possessions, and I can assure you that the opportunities and conditions are far more favorable for their being given such instruction in this country than in our tropical possessions. The extensive experience of Great Britain should serve as a criterion in this respect, and the applicant should have his fundamental training in a school at home. This is a question not only of scientific, but of vast national importance as well. This country owes a duty to its tropical and subtropical dependencies, and to those who do its work in climates more or less dangerous or even deadly to Americans. Adequate and special training in tropical medicine should be insisted upon for all applicants before appointment is made. Until recently, at least, complete and satisfactory courses in tropical medicine have not been offered by our universities, but the time has now come when greater opportunities should be established for the training of a large body of medical men who shall devote themselves to the acquisition of the knowledge required for a better understanding of a successful warfare against tropical diseases. It would be to the best interests both of tropical medicine in this country and to our government if a civil medical service could be established along similar lines to the colonial medical service in Great Britain. Appointments to such a service should only be made of individuals who had received thorough training in tropical medicine and shown special aptitude in such work. Opportunities should be offered for advancement and a permanent career. By means of such a service it is believed that the most favorable results could be obtained in con-

nection with the many problems relating to tropical diseases and their prevention, and when such emergencies arise, such as may shortly do, in connection with the Mexican situation, a trained body of medical men would be already available.

Conclusion.

Of the value of an introductory address of this nature I am doubtful. Your time probably could be much more profitably employed in discussing and listening to the discussion of the various themes upon our scientific program. However, if I can but succeed in reaching the ear of one able individual who will turn a helping hand towards the needs of tropical medicine in this country, or if I can but succeed by having recited some of the opportunities in relation to this study in "rousing" in the breast of some hopeful investigator sufficient enthusiasm and courage to "gird him on" to the quest of tropical researches, I shall feel that I have done my part to-day.

Wish upon wish to nobly gain.
Wake up! behold the rising sun
Those hovering clouds will break in rain!
Rend sleep's brief thrall and gird thee on.
Rouse thee! be bold! and greatly strive.
Heed not the falt'ring, loitering throng.
The lofty soul can all achieve
Whose thought is swift, whose grasp is strong.

THE INFLUENCE OF TROPICAL RESIDENCE ON THE BLOOD.*

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Introduction.

A study of the blood state prevailing among apparently healthy persons resident in hot countries is of much importance for two reasons: *firstly*, because of the scientific interest attaching to a determination of the possible alterations produced in the circulating fluid by the conditions peculiar to the Tropics; and *secondly*, because such alterations, if they exist, may be mistaken for the causes or the effects of certain tropical diseases. During the years 1910 to 1912, while President of the U. S. Army Board for the Study of Tropical Diseases as They Exist in the Philippine Islands, I had occasion to analyze many thousands of blood examinations and blood-pressure readings, a part of which were made by me personally and the remainder under the supervision of myself or my immediate predecessor, Major J. M. Phalen, Medical Corps. The observations were carried out on about fifteen hundred presumably healthy adult male residents of the Philippine Islands.

This work had to do with both natives and Americans. The results obtained form the basis of the present paper. The subject will be discussed under three heads: *first*, erythrocytes and hæmoglobin; *second*, leucocytes; and *third*, the significance of the findings.

Erythrocytes and Hæmoglobin in the Philippines.

In the year 1908 Wickline reported on an extensive series of blood examinations performed on American soldiers who had

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arrived in the Philippines in June, 1905. (1) The first observations were made in September, 1905, and were repeated at intervals up to April, 1907. During this period of 20 months there was a gradual rise in the number of red cells per cubic millimeter up to 5,330,888, a progressive fall in the hæmoglobin percentage from 94 to 83, and consequently a color index materially below unity. The details of this work are given in Table I.

TABLE I. Wickline's average estimation of the erythrocytes and hæmoglobin of American officers and soldiers who arrived in the Philippines in June, 1905.

NUMBER OF MEN EXAMINED	DATES OF EXAMINATION	AVERAGE NUMBER OF ERYTHROCYTES PER CUBIC MILLIMETER	AVERAGE HÆMOGLOBIN PER CENT	AVERAGE COLOR INDEX
70	Sept. 1905	4,980,555	94	0.94
104	Dec. 1905	5,344,595	89	0.83
97	Aug. 1906	5,429,960	86	0.79
81	Apr. 1907	5,330,888	83	0.78

Below are presented tables showing the results which I obtained in the Philippines.² All of the men under observation were healthy American soldiers performing their full military duty. The average age for the group was 26 years. The stations where these men served were for the most part near sea level, and none were at an altitude exceeding 600 feet. It will be observed that the results for the larger group (Table III) agree with those of Wickline in general character, though the alterations which he found with increasing length of tropical residence were more pronounced than in my series. My average erythrocyte counts at the different periods ranged from 5,111,000 to 5,355,000, with an average hæmoglobin percentage between 88 and 90. Consequently the color index was considerably below unity, varying from 0.82 to 0.88. Among 687 men who had resided on an average of 20 months in the Philippines, 20.2 per cent showed red counts below 4,750,000; 66.7 per cent between 4,750,000 and 6,000,000; and 13.1 per cent were above 6,000,000. Ninety per cent of the men gave hæmo-

2. The red cells were counted with the Thomas-Zeis hæmocytometer. The hæmoglobin estimations were made in most cases with Dare's hæmoglobinometer, and in the remainder with the von Fleischl instrument. The large number (twenty-four) of individual observers who took part in this work reduces to a minimum the influence of the personal equation. The group of men observed is so large that the element of chance is eliminated.

globin readings of 85 per cent or over after 20 months of tropical residence . In 63 per cent the reading was 90 per cent or upwards.

TABLE II. Average erythrocyte counts and hæmoglobin estimations on 65 American soldiers who, at the date of the first examination, had served on the average 14.9 months in the Philippines. Average age of men 25.3 years.

DATES OF EXAMINATIONS	AVERAGE NUMBER OF ERYTHROCYTES PER CUBIC MILLIMETER	AVERAGE HÆMOGLOBIN PER CENT	AVERAGE COLOR INDEX
January, 1909.....	5,276,000	89.3	0.85
July, 1909.....	5,355,000	88.2	0.82
December, 1909.....	5,152,000	90.0	0.87

TABLE III. Average erythrocyte counts and hæmoglobin estimations on 601 American soldiers who, at date of the first examination, had served on the average 6.6 months in the Philippines. Average age of men 27.7 years.

DATES OF EXAMINATIONS	AVERAGE NUMBER OF ERYTHROCYTES PER CUBIC MILLIMETER	AVERAGE HÆMOGLOBIN PER CENT	AVERAGE COLOR INDEX
May and June, 1910.....	5,111,000	90.3	0.88
May and June, 1911.....	5,206,000	89.6	0.86

TABLE IV. Range of erythrocyte counts for 687 healthy American soldiers who, at date of count, had served on the average 20 months in the Philippines.

RANGE OF ERYTHROCYTE COUNT PER CUBIC MILLIMETER	NUMBER OF MEN	Per Cent of Total Number	RANGE OF ERYTHROCYTE COUNT PER CUBIC MILLIMETER	NUMBER OF MEN	Per Cent of Total Number
Under 4,000,000.....	15	2.2	5,500,000 to 5,749,000.....	76	11.1
4,000,000 to 4,249,000.....	26	3.8	5,750,000 to 5,999,000.....	39	5.6
4,250,000 to 4,499,000.....	37	5.4	6,000,000 to 6,224,000.....	35	5.1
4,500,000 to 4,749,000.....	60	8.8	6,225,000 to 6,499,000.....	24	3.5
4,750,000 to 4,999,000.....	112	16.3	6,500,000 to 6,749,000.....	12	1.7
5,000,000 to 5,224,000.....	155	22.5	6,750,000 to 6,999,000.....	14	2.1
5,225,000 to 5,499,000.....	77	11.2	Over 7,000,000.....	5	0.7

TABLE V. Range of hæmoglobin readings for 702 healthy American soldiers who, at date of examination, had served on the average 20 months in the Philippines.

RANGE OF HÆMOGLOBIN	NUMBER OF MEN	Per Cent of Total Number	RANGE OF HÆMOGLOBIN	NUMBER OF MEN	Per Cent of Total Number
Under 80 per cent.....	8	1.1	90 to 94 per cent.....	261	37.2
80 to 84 per cent.....	64	9.2	95 to 99 per cent.....	136	19.4
85 to 89 per cent.....	185	26.4	100 per cent or over.....	48	6.7

For comparison with the above records for white men it is interesting to note that in India McCay found among male Bengalese an average of 5,300,000 red cells per cubic millimeter, 81 per cent of hæmoglobin by Haldane's method, and a color index ranging between 0.74 and 0.85. (2) Among 29 healthy Filipino adult males I found an average of 93 per cent of hæmoglobin, the lowest reading being 85 per cent and the highest 100 per cent.

If we grant that the blood of healthy young white men after 20 months residence in the Philippines will contain about 5,300,000 erythrocytes per cubic millimeter, and 88 to 90 per cent of hæmoglobin, it remains to decide whether this condition differs from that prevailing in the temperate zone. I believe it does not. The more recent works on the blood corpuscles have shown that among young adult males residing at or near sea level in temperate climates the average red cell count may rise very materially above the conventional 5,000,000 per cubic millimeter, reaching not infrequently upwards of 5,500,000.³ Regarding the normal hæmoglobin percentage in the United States, my own experience, as well as that of others,⁴ has been that readings of 100 per cent are not to be expected when using the von Fleischl instrument. In a series of 70 healthy American soldiers stationed in New Orleans, uncinariasis having been ruled out in each individual, the average hæmoglobin estimation was 94.2.²³ Stierlin set the average as

3. It is stated by Cabot that counts of 6,000,000 are by no means rare among healthy young men and higher figures are found occasionally. Emery writes that the red cells are often above 5,000,000 (25). For 50 young medical students in the United States Hewes (3) found an average of 5,809,000, the lowest count being 5,120,000. Sorensen (4) found an average of 5,606,000 for male students ranging from 19.5 to 22 years of age, and of 5,340,000 for young physicians from 25 to 30 years old. Ewing, (5) referring to Welker's estimate of the normal red cell count as 5,000,000 in men and 4,500,000 in women, says: "Perhaps the chief contribution of later observers using Thoma's instrument has been the proof that the numbers are more apt to exceed rather than to fall below these averages, especially in men, a fact that has become more certain from the careful estimates of the last decade. Thus the average obtained by Helling was 5,910,000; by Frederickson, 5,072,000; Zaslein, 5,010,000; Neubert, 5,603,000; Graber, 5,081,000; Stierlin, 5,752,000; Reinicke, 5,209,667; Andriezen, 6,000,000; Hayem, 5,500,000."

4. Faught (6) considers 90 or 95 per cent to be normal with the von Fleischl apparatus. The relative percentage of hæmoglobin, as estimated by clinical hæmoglobinometers, is figured by Stierlein (7) to be 88.8 for ages 18 to 25 years and 100 for ages 25 to 45 years.

low as 88.8 per cent for men between 18 and 25 years of age. In view of these observations my mean results of 88-90 per cent in the Philippines, for groups averaging 25 to 27 years, cannot be called abnormal, and even Wickline's last findings of 83 per cent can scarcely be considered sufficiently low to indicate a definite state of anæmia or chlorosis.⁵ Of course, with a red cell count well above 5,000,000 and a hæmoglobin percentage about 90, the color index will be considerably below unity, and an index of 1 is not to be expected either in the Tropics or the temperate zone.

The Leucocytes in the Philippines.

Regarding the number of leucocytes, my observations showed nothing unusual for either whites or natives. The mean count for 62 healthy Americans with an average service of 14.6 months in the Tropics was 7,304 white cells per cubic millimeter, and for another group consisting of 175 Americans with an average tropical service of 20 months (no man having less than 14 months) was 7,062. For 29 apparently healthy Filipino adult males the white cells averaged 9,248. For comparison McCay found an average of 9,000 leucocytes among Bengalese in India. (2) These mean counts of 9,000 and 9,248 for natives may seem a trifle high, but are at least well within the normal upper limit of 10,000 set by Cabot, Buchanan, and Simon, for temperate regions.

5. The question is sometimes raised as to whether tropical sunlight, especially through the action of the ultra-violet and other rays of short wave-length, produces an effect on the blood. In this connection it is of interest to note that neither the complexion type of the men (blond or brunette) nor the use of orange-red undergarments (obstructive to actinic rays) appeared to exert any influence on the red cell count of the hæmoglobin. A possible effect of complexion on the leucocytes will be mentioned further on. (8) (9) (10).

TABLE VI. Range of leucocyte counts per cubic millimeter in the Philippines.

RANGE OF COUNT	FOR SIXTY-TWO AMERICAN SOLDIERS WITH 14.6 MOS. AVERAGE TROPICAL SERVICE		FOR TWENTY-NINE HEALTHY ADULT FILIPINO MALES	
	Number of Men	Per Cent of Total Number	Number of Men	Per Cent of Total Number
4,000 to 5,000	1	1.6	0	.....
5,000 to 6,000	8	12.8	1	3.5
6,000 to 7,000	13	20.9	1	3.5
7,000 to 8,000	23	37.1	4	13.7
8,000 to 9,000	11	17.7	8	27.7
9,000 to 10,000	4	6.4	6	20.6
10,000 to 11,000	2	3.2	4	13.8
11,000 to 12,000	0	.....	4	13.7
12,000 to 13,000	0	.....	1	3.5
	Average count, 7,304		Average count, 9,248	

Turning to the ordinary differential count of the white cells, it will be seen that the percentages met with in the Philippines differ somewhat from the accepted standards at home. Wickline in 1905 to 1907 found among American soldiers that the polymorphonuclear elements averaged 54.9 per cent and the small lymphocytes 33.4 per cent. (1) He showed that this condition was not present on arrival in the Philippines, but developed during residence there. Guerrero and Sevilla, working with Filipinos at Taytay, near Manila, obtained averages of 51.6 per cent for the polymorphonuclears, and 34.5 per cent for the small lymphocytes. (11) The percentages which I found in four different series of examinations confirmed the observations of Wickline, and of Guerrero and Sevilla, as to the material reduction in the percentage of polymorphonuclear neutrophils and the rather high small lymphocyte counts. The relative reduction in polymorphonuclear cells is most marked for Filipinos, the average counts ranging in the different series from 47 per cent to 52 per cent, while for healthy American soldiers with more than one year of tropical service the polymorphonuclear estimations lay between 55 and 59 per cent. Fifty-eight per cent of the white men and 72 per cent of the Filipinos showed polymorphonuclear percentages under 60. The total lymphocyte percentages (large and small) for the two races did not vary materially, and the differences between the polynuclear counts for Americans and for Filipinos were due to the much greater number of

eosinophiles met with among the natives as a result of their very general infection with intestinal parasites and the frequent presence of skin diseases. The details of these various series of leucocyte examinations are shown in Tables VII and VIII.⁶

TABLE VII. Reduction in the polymorphonuclear neutrophiles found in the Philippines.

Series	OBSERVERS	RACE	Number Observed	Residences in Philippine Islands	Polynuclears	Eosinophiles	Small Lymphocytes	Large Lymphocytes ^{e)}	Mast Cells
1	Wickline (1)	Americans (a)	104	Batangas	54.9	5.1	33.4	6.1	0.5
2	Guerrero & Sevilla (11)	Filipinos	129	Taytay	51.6	11.2	34.5	4.1	0.2
3	Tropical Board (8)	Americans (b)	115	Various	58.7	3.6	32.6	4.6	0.5
4	Tropical Board (12)	Igorots (c)	40	Baguio	46.9	8.9	37.2	5.7	0.4
5	Tropical Board (13)	Americans (d)	72	Various	56.8	3.8	31.7	6.9	0.8
6	Tropical Board (13)	Filipinos (c)	50	Various	52.2	10.6	29.9	6.6	0.7

a. These were all soldiers who had served continuously in the Philippines over 18 months at the time the counts were made.

b. All the members of this group were soldiers who had been in the Philippines over a year.

c. All of this group were adult males,

d. All of these were soldiers with an average of 14 months continuous Philippine service.

e. Includes transitional forms.

TABLE VIII. Range of polymorphonuclear percentages in the Philippines.

RANGE OF PERCENTAGE	FOR 72 AMERICAN SOLDIERS WITH 14.6 MOS. AVERAGE PHILIPPINE SERVICE		FOR 50 ADULT MALE FILIPINOS	
	Number of Men	Per Cent of Total Number	Number of Men	Per Cent of Total Number
Under 40	2	2.8	6	12.0
40 to 45	6	8.3	7	14.0
45 to 50	6	8.3	7	14.0
50 to 55	10	13.9	11	22.0
55 to 60	18	25.0	5	10.0
60 to 65	15	20.7	8	16.0
65 to 70	12	16.6	3	6.0
70 to 75	3	4.1	2	4.0
75 to 80	0		1	2.0
Average, 56.8 per cent			Average, 52.2 per cent	

6. In all of the counts made by me care was taken to count back and forth completely across the slide to avoid obtaining an undue number of small lymphocytes which are liable to be relatively more numerous in the central portion of the slide than they are at the borders.

While the above figures show a *relative* lowering, that is a percentage decrease, in the polymorphonuclear count of the natives, as compared with Americans, it is worthy of note that *absolutely* the native had more polymorphonuclear elements per cubic millimeter than the white man. With 8,248 leucocytes, 52.2 per cent of which were polynuclears, the Filipino has 4,827 polynuclear cells per cubic millimeter, as compared with only 4,148 for the white man (56.8 per cent of 7,304 whites). This total polymorphonuclear leucocyte count of 4,827 for the Filipino is as high as for the white man in the United States if we take 7,000 white cells as a standard, with 65 to 70 per cent of them polymorphonuclears. By this same method of reckoning, the absolute lymphocyte count of the natives is found to be decidedly high, 2,765 small lymphocytes and 610 large lymphocytes as compared with an average of 1,400 and 350 for temperate climates. In other words, the absolute number of lymphocytes was nearly doubled in the Filipinos. (24)

As far as I am aware, my Arneth estimations, made in 1910, were the first reported from the Tropics. (14) The results obtained among the Filipinos was so unexpected and interesting that the investigation was continued in association with Captain Edward B. Vedder, Medical Corps, U. S. Army, and reported on in 1911. (13) In all we performed 50 Arneth counts on healthy adult Filipino males, and 72 on healthy American soldiers whose average length of tropical service at date of examination was 14.6 months.⁷

For the white man there was a slight movement to the left in the Arneth picture, but probably not sufficient to be of significance.⁸ For the Filipinos there was a very decided shift

7. The work was done independently on different men, and the averages obtained by the two observers showed but a small percentage of variation (13). Each observer clearly demonstrated a marked shift to the left for Filipinos.

8. Some differences in the leucocyte conditions were found which depended apparently on the complexion type of Americans. For blonds the white count averaged 6,980, the polynuclears 54.8 per cent, and the Arneth index 43.1. For brunettes the figures were 7,155, 59.6 and 49.0 respectively. Even if the hypothesis discussed later is correct, these figures would not indicate lowered resistance (through the agency of diminished phagocytosis) on the part of the men of fair complexion. The blonds showed both relatively and absolutely a diminution of polymorphonuclear elements as compared with brunettes. On the other hand, the shift to the left in the Arneth picture was decidedly more pronounced for the brunettes. Figured out per cubic millimeter there is found to be of the most efficient phagocytes (Classes III and IV) 2,105 for blonds and 2,106 for brunettes (8) (9) (10).

to the left, the Arneth index being 65.8 for Filipinos, as contrasted with 46.2 for the white man. These indices are to be compared with indices ranging from a minimum of 25 to a maximum of 56, which have been set by various authors as standards in the northern countries. The details of our results, paralleled by the accepted standards for the temperate zone, are shown in Table IX.

TABLE IX. Arneth counts in the Philippines as contrasted with normal averages in Europe and America.⁹

	ARNETH'S CLASSIFICATION. PER CENT					Arneth's Index
	Class I	Class II	Class III	Class IV	Class V	
Average for 72 healthy American soldiers with 14.6 month's average Philippine service	13.3	32.9	37.2	14.6	2.0	46.2
Average for 50 healthy Filipinos	27.5	38.3	25.8	7.5	0.9	65.8
Normal in Europe (Arneth).....	5	35	41	17	2	40.0
Normal in New England (Kagan).....	5	19	46	25	5	24.0
Normal in U. S. (Williams) (15).....	8	36	42	13	1	44.0
Normal limits (Simon).....	4-9	21-47	33-48	9-23	2-4	25-56

Significance of the Blood Findings in the Philippines.

To sum up what has gone before regarding the red elements, examination of white men after a year or more of residence in the Tropics gives an average erythrocyte count well above 5,000,000, a hæmoglobin percentage between 88 and 90, and a color index ranging from 0.82 to 0.88. For Filipinos the average hæmoglobin estimations were 93 per cent. These figures do not indicate an impoverished condition of the blood. The expression "tropical anemia" is often found in the earlier treatises on the diseases of hot countries, and is still heard not infrequently. It is my belief that such a condition, *due to the effect of climate per se*, does not exist. More recent investi-

9. The total leucocyte count and the ordinary differential counts for these same men are shown in Table VI, and in Series 5 and 6, Table VII. The individual counts for the men can be found in Tables V and VI in article shown under reference (13).

gations have shown that much of the anemia formerly classed as "tropical" was in reality secondary to infections with plasmodia, uncinaria and leishmania. Scheube says: "There is no anemia due to climate alone." (16) The studies of Marestang, van der Scheer, Glongner and F. Plehn on white men living in the Tropics showed no material deviations from the normal blood conditions observed in Europe. (16) Castellani and Chalmers state that a certain number of Europeans in the Tropics take on "a peculiar whitish color even in cases in which the blood examination does not reveal any sensible decrease in the amount of hæmoglobin." (2) Eijkman also refers to this phenomenon. Lehman and van der Scheer, (16) and Musgrave and Sison (17) consider this pallor of the skin to be a local vaso-motor condition, in other words, a cutaneous ischemia. This explanation seems to me very satisfactory. My own experience, based on nearly 7,000 blood pressure readings on about 1,500 Americans and natives in the Philippines, has shown that the blood pressure is the same for both races, averaging 116 millimeters of mercury at the age of 25 years, when taken with a 12.5 centimeter arm-let. (18) These averages are little if any lower than those found in temperate climates. In a land characterized by an atmosphere which is always relatively warm there is no need for maintaining, through the agency of the circulation, a surface temperature as high as that required in a cold climate, where bodily heat is continually being conducted away. Since the character of the blood and the degree of blood pressure are the same in the Tropics as at home, it is obvious that the simplest manner of reducing the supply of blood to the surface is by constricting the superficial vessels. The theory of a cutaneous ischemia will not only explain the occurrences of tropical pallor, but will also account for the fact of its disappearance in a few days on returning to a cold region.

Further observations on the condition of the blood in the Tropics will be of much interest. Estimations as to the water, total solids, salts, and ratio of salts in the urine to those in the blood, are needed. The only work along this line with which I am familiar was done by McCay in India. (2) It needs to be repeated in other parts of the Tropics. It is still an unsettled

question whether the proportion of water in the blood is reduced in the hot countries as a result of excessive perspiration.¹⁰ McCay's observations on Bengalese did not indicate that it was. My own investigations showed that American soldiers lost 1.3 per cent of their original weight during a residence of 19 months in the Philippines. (9) (19) The percentage of loss was the same for large as for small men. Could this decline in weight have been due to a diminution in the watery constituents of the blood?

Summing up the findings recorded above in regard to the leucocytes, it will be remembered that for Americans, after 14 months of tropical service, the average white count was normal, slightly exceeding 7,000, the polymorphonuclear percentage was relatively, as well as absolutely, lower than the established standard in northern climates, and the Arneth picture showed a very slight shift to the left. For Filipinos the movement to the left in the Arneth picture was decided, the relative reduction in the polymorphonuclear leucocytes was more marked than for the Americans, but the absolute number of polymorphonuclear elements per cubic millimeter was greater than that for the white men because the number of leucocytes averaged about 2,000 higher, 9,248 as compared with 7,062 or 7,304.

I will now discuss briefly a possible significance that may attach to the white cells findings in the Philippines. It is a well-accepted theory that the polymorphonuclear neutrophile is the chief phagocytic cell of the blood.¹¹ The five classes set up

10. It has been suggested by some that the rather high red cell count met with in the Tropics is due to a concentration of the blood resulting from excessive sweating. It is stated by Gulland and Goodall that profuse perspiration leads to a slight increase in the number of leucocytes, chiefly in the polymorphonuclears (24). Since the blood of white men in the Philippines showed no increase in the leucocytes and a decrease in the polynuclears, it does not appear that excessive perspiring can be invoked as a cause of the bountiful erythrocyte count.

11. The lymphocytes (which are in excess in the blood of both whites and natives in the Philippines) are not considered to have phagocytic qualities. Buchanan claims that the "coarse eosinophiles are actively amoeboid and to a certain extent phagocytic" (7), while Kanthack and Hardy believe that they never behave in this way (20). Westbrook considers phagocytosis by eosinophiles an extremely rare occurrence (20). It is also stated that virulent living bacteria act in a negatively chemotactic manner on eosinophiles (7). Buchanan thinks that the large mononuclears act as phagocytes (7), but Kanthack and Hardy consider these cells to be capable of immediate action only in the case of feebly virulent bacteria. Some, who claim that the large lymphocytes are phagocytic, state that they have a predilec-

by Arneth represent polymorphonuclear neutrophiles with one, two, three, four or five nuclear fragments or lobes respectively. Arneth claims that classes I and II represent immature leucocytes which are less able to protect the body from bacterial invasion than are the white cells with three or four nuclear fragments. Pottenger reports that the phagocytic power of the leucocytes for staphylococci rises progressively from Class I to Class IV inculsive, and diminishes in Class V. (21) On the other hand, Buchanan, using cocci, could not detect any relation between the degree of nuclear fragmentation and the number of bacteria engulfed. Turning from experimental researches to clinical observations, it will be found that most of the work with the Arneth classification has been performed on patients suffering from tuberculosis. It is quite generally accepted that a marked shift to the left indicates lowered resistance to the progress of that disease. In other words, a high Arneth index (excess of Classes I and II) goes hand in hand with a low resistance, or with a high degree of toxic and bacterial absorption which is bringing about the destruction of the actively phagocytic leucocytes (Classes III and IV). By a large number of examinations in various diseases, Arneth has demonstrated to his own satisfaction a direct relationship between the blood picture and the course of the disease in question. The Arneth picture is therefore considered an index of the protective efforts of the human organisms against bacterial infection. (22)

We have, therefore, in the case of the Filipinos considered in this paper: *first*, a total white cell count not exceeding normal limits; *secondly*, a markedly low percentage of the only circulating phagocytic cells, the polymorphonuclear neutrophiles; and *thirdly*, of this diminished quota of phagocytes an abnormally high percentage belongs to Arneth's Classes I and II, which are believed to represent cells relatively deficient in phagocytic power. Therefore, *the blood of these Filipinos showed an absolute reduction in efficient phagocytes*, the cells which,

tion for the infective organisms causing chronic diseases, such as leprosy, tuberculosis and actinomycosis, while the microphages are concerned in the destruction of the bacteria producing acute infections (26). That certain fixed cells, notably endothelial cells, have phagocytic power is generally accepted, but the extent and manner of their action is not fully understood, and they need not be considered in this study of the blood.

with the aid of opsonins, are supposed to be concerned in destroying bacterial invaders. If further investigation shows that such a condition is habitually found in the blood of a tropical race it may indicate, on the part of that people, a diminished resistance to some or to all infections. This explanation is merely offered as an hypothesis which can be established only by much more extensive observation both in the laboratory and at the bedside. It opens a field for speculation as to whether the slight deviations in the same direction met with in the blood of Caucasians resident in the Philippines is an indication of beginning loss of resistance to infections on the part of these individuals who have been removed from their natural environment.¹²

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¹². It is proper to mention some of the possible causes for the blood conditions found in the Filipinos. Those who see a deleterious influence in a hot climate *per se* might claim that they were due to the action of heat or humidity, or the actinic power of the sunlight. Food is another factor which might conceivably affect the blood-picture. McCay considers that a dietary very low in protein, such as a rice diet, produces a demonstrable change in the circulating fluid, and lowers the physique, the capacity for work, the health, and the powers of resistance to disease (2). He did not report on any Arneth counts. It would be of interest for comparison to apply Arneth's method to Japanese and Chinese living in a cool climate, but subsisting mainly on rice. The very great prevalence of intestinal parasites among Tropic races is well known to influence the blood-picture in the direction of eosinophilia. Whether this factor also affects the Arneth count has not been worked out as far as I am aware. Among the Filipinos in our series one must consider the possible influence of tuberculosis, which is extremely common in the Philippines. All our counts were made on apparently healthy laborers, but no special tests were made to exclude the possibility of incipient or latent tuberculosis. I do not believe that early tuberculosis could have been sufficiently prevalent to have affected the whole series of Arneth counts so materially. The presence of a widespread and often latent affection, such as beri-beri, is also worthy of consideration. The only investigations bearing on the Arneth picture in beri-beri with which I am familiar are those of Mathis and Leger. These observers found that in beri-beri the lymphocytes were increased and the Arneth count showed a pronounced shift to the right (27) (28). These findings contrast sharply with our observations on healthy natives.

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Discussion.

DR. JOHN M. SWAN, Rochester, N. Y.: In the few cases in which I have had the opportunity of examining the blood of people returned from the Tropics, I can confirm the statement made by Dr. Chamberlain concerning the increase of lymphocytes in the differential count. In parts of the world in which diseases of the ductless glands, particularly of the thyroid gland, are common, the same increase in lymphocytes is a frequent condition. It has occurred to me that possibly the lymphocytosis seen in apparently normal individuals in the Tropics may be due to ductless gland, particularly thyroid influence.

DR. RICHARD P. STRONG, Boston, Mass.: It would be interesting to pursue the work that Dr. Chamberlain has done making continuous observations on white persons living in the Philippine Islands for a period of ten years or more. Similar observations ought to be made on the children of white people born in the Tropics.

DR. MILTON J. ROSENAU, Boston, Mass.: It seems to me that the study of the blood platelets ought to be included in a study of the blood in persons living in the Tropics. It has been noted during studies made in connection with yellow fever that the blood platelets present quite marked differences in different diseases.

DR. MAURICE COURET, New Orleans, La.: Is syphilis very prevalent in the Philippine Islands? Does Dr. Chamberlain include the large mononuclear cells with the lymphocytes in making differential counts? Frequently a differentiation between the lymphocytes and leucocytes of endothelial origin give a very different blood picture.

DR. WESTON P. CHAMBERLAIN, Plattsburgh, N. Y.: The Filipinos whose blood was studied in the preparation of this paper were presumably healthy men; but they were not carefully examined so as to exclude latent tuberculosis, for example. The small lymphocytes were always separated from the large mononuclear leucocytes. In beri-beri, the Arneth formula has shown the shift to the right. Reports are diverse concerning the prevalence of syphilis among Filipinos. In my experience it is not as common as it is among white men in America.

DR. RICHARD P. STRONG, Boston, Mass.: In my experience syphilis among native Filipinos is more frequent than it is among white men in the United States.

TRACHOMA.*

By

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The conspicuous ravages of trachoma or Oriental ophthalmia in many tropical and sub-tropical countries certainly justify its consideration as a tropical disease. There are numerous well-authenticated instances of the introduction of the disease from tropical countries into more temperate regions where trachoma had previously been unknown or at least unrecognized. Its presence in Europe has been ascribed such an importation by Napoleon's soldiers returning from their campaigns in Egypt and the Levant. Just where in the world trachoma may have originally started we do not know any more than we know where many other diseases originated. We can see, however, from the way eyelids are represented in carved figures and inscriptions which date back to the early Egyptian and Assyrian civilizations that even in remote antiquity trachoma existed in these regions which are to-day hotbeds of disease. We know now, however, that the prevalence of trachoma is not a matter of climatic conditions, but of habits of living which favor the spread of infection in localities where infection may happen to be introduced. We know that trachoma was not an uncommon disease in certain localities in Europe and even in America long before Napoleon's day, and quite probably since prehistoric times. In fact, trachoma is to be found prevalent among certain people in widely separated localities scattered over the whole world.

The spread of the disease offers to-day a serious economic and sanitary problem not only in Egypt and India, China and Japan, but in Russia, Austria-Hungary and Italy, among the Indians and Esquimaux of Alaska, in some of the South Sea Islands, and even in many localities in the United States.

Probably more than anything else which has occurred in

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recent years to arouse an international interest in trachoma is the result of the action which the United States government took in 1897 in declaring trachoma to be a "dangerous contagious disease," thus putting immigrants afflicted with trachoma squarely within a class of aliens declared by statutory law to be inadmissible to the United States. This action was taken because of representations from ophthalmological organizations and state and municipal authorities that with the change in origin of our immigration from Northwestern to Eastern and Southern Europe trachoma was being brought into this country to such an extent as to constitute a national menace.

I well remember that when this order first went into effect it was nothing unusual for us at Ellis Island to send back seventy-five cases of active trachoma in a highly contagious stage from among the arriving passengers of a single ship. The rigid exclusion of immigrants afflicted with trachoma has accomplished what it was intended to accomplish and the conditions in our large centers of population which brought about this attitude of our federal government with respect to trachoma have long ceased to exist.

I am informed that here in Boston eye clinics which once were devoted almost exclusively to the treatment of trachoma have been closed from lack of patients. An active case of trachoma is certainly a rare disease here in Boston to-day. With the disappearance of the conditions which led this country rigidly to exclude cases of the disease there has become manifest an organized agitation in favor of again letting down the bars. The pressure in this direction is tremendous and finds constant expression in efforts to arouse public sympathy for immigrants refused admission because of the disease and to create an impression that the contagiousness of the disease has been exaggerated or that it can be quickly cured by some comparatively simple operative procedure. The cause of this agitation is not hard to find. The present attitude of our government in regard to trachoma not only prevents thousands of foreign-born residents of this country from bringing here their families and relatives, but acts as the sole obstacle to

wholesale migrations here of people from many badly infected districts of Eastern Europe and Asia. Then, too, the commercial consequences of our attitude with respect to the disease are not to be overlooked. About seven years ago a representative of one of the large steamship companies stated at a conference at Washington, at which I was present, that it was estimated that the steamship companies were then refusing passage to 100,000 prospective immigrants annually because they were found to be afflicted with trachoma, from which statement it is evident that our exclusion of trachoma is, or was then, reducing possible profits from the immigrant traffic to the extent of millions of dollars a year.

Trachoma has also another feature of interest and concern to us in this country. Recent investigations have shown that this country has a serious trachoma problem on its hands, not as the result of recent foreign immigration, but due to infection dating back certainly to colonial times, if not earlier. A systematic investigation made by the United States Public Health Service showed that out of a total of 39,231 of our Indians examined on Indian reservations, 8,940, or 22.7%, were afflicted with trachoma. Among 16,470 pupils in Indian schools, 4,916 cases of trachoma were found.

A similar survey among the population of old native stock in our Southern States disclosed the following conditions:

In Jefferson County, Ky., out of 35,397 school children, 805 cases of active trachoma were found. In West Virginia, among a similar native population, 237 cases of trachoma were found in 16,153 school children. As surveys of the population in that part of the country have progressed it has become evident that trachoma is very prevalent all through the central portion of our Southern States, that the disease is a common cause of lack of economic efficiency and even total blindness in this region, and that in certain districts conditions are very serious.

What is trachoma? Trachoma might be termed a disease of the eyelids due to some specific and as yet unknown toxic agent. In a typical case this toxic agent produces a characteristic hyperplastic granular conjunctivitis which gradually causes a more or less complete destruction of the conjunctiva.

To understand how the characteristic symptoms of the disease are produced let us review in part the histology of the eye.

The conjunctiva which covers the eyeball and lines the eyelids is a thin transparent membrane loosely attached to the underlying tissues. Except perhaps in the early years of life there are to be found interspersed through the connective tissues beneath the palpebral conjunctiva of both eyelids, numerous lymphoid cells. In the upper lid these lymphoid cells are most abundant in the looser tissue back in the retrotarsal fold and least so where the conjunctiva lies over the tarsal cartilage. The amount of this lymphoid tissue varies normally in different individuals. Under all sorts of irritative stimuli these lymphoid cells exhibit a ready tendency to proliferate, increase greatly in numbers and group together in masses. If the whole eyelid be not infiltrated and swollen the masses of lymphoid cells will raise up and show through the conjunctiva, giving the eyelids when everted a more or less granular or frog spawn appearance. This appearance, which is likely to get called follicular conjunctivitis, granular eyelids or perhaps even trachoma, is of no diagnostic value whatever, so long as these conjunctival granules are soft and compressible. A pneumococcus or other bacterial infections may bring about this condition. Even a foreign body in the eye may produce this follicular conjunctivitis. It is a frequent concomitant of adenoids in children. Among the many things that will start up this condition is the infective agent of trachoma, so when you see a follicular appearance of the eyelids of a child even with little inflammatory reaction, do not be sure that you are not dealing with a beginning trachoma, unless you can exclude the possibility of contact with trachoma cases. Whether or not this process be a beginning trachoma can be told clinically only by waiting. If these follicles remain soft and unchanged in appearance or tend to disappear spontaneously or with superficial medication then one is not dealing with a case of trachoma. There is no reason to believe that a trachoma infection which has once caused a marked proliferation of the subconjunctival lymphoid cells ever subsides without eventually giving rise to some characteristic clinical symptoms of the disease. These

symptoms manifest themselves first as a recognizable hardening of at least some of the granules which dot the conjunctiva and which later by the extrusion of their contents give rise to little raw-looking points, the eventual healing of which brings about a cicatrization of the eyelid. The minute changes which take place in this process are as follows: As the lymphoid cells proliferate under the influence of the infective agent of trachoma the follicles tend to degenerate and become encapsulated by newly formed connective tissues. In connection with this process new blood vessels are also formed which permeate to some extent the interior of the follicle. As the inflammatory process continues these little, round, firm capsules are pushed up into and coalesce with the conjunctiva. Their contents break down. The overlying conjunctiva becomes involved in the same degeneration and gives way. The contents of the capsule are discharged, giving rise in this stage of the disease to the little raw points and the little spot of destroyed conjunctiva is replaced by scar tissue. In this way the disease tends to destroy bit by bit the entire conjunctiva. As a result also of the changes which take place beneath the surface there is a permanent obliteration of the normal blood vessels and a general atrophy of the lid. At a very early stage a cross section of a trachoma follicle will reveal under the microscope the characteristic changes in the follicle just mentioned, although of course such a procedure is not usually practicable for diagnostic purposes. The cause of trachoma is not known. From time to time investigators have thought they have found something which might bear a causative relation to the disease, but up to the present one claim after another of this sort has been discredited.

The question might be therefore asked right here, why do we believe that this characteristic train of symptoms and these microscopical changes are always produced by a single causative agent? Why can't different kinds of bacteria or different causative agents produce these same inflammatory changes? One answer is that trachoma never arises sporadically. Where you find one case of trachoma you find others if you look for them. Then there may be coupled with such evidence the

fact that trachoma can be inoculated from one human being to another. In the Austrian army, recruits, to avoid service, will bring on the disease by putting a metal coin under the eyelid of a person afflicted with trachoma and then put it under their own eyes. Looking at the proposition from another point of view, there are some twenty-five different kinds of bacteria which we know with reasonable certainty can and do produce inflammatory conditions of the conjunctiva, often resulting in destructive changes.

These bacteria include the Klebs-Löffler, lepra and tubercle bacilli, the gonococcus, pneumococcus and other bacteria more usually identified with disease processes elsewhere in the body, although the pneumococcus and influenza bacillus are very common causes of a conjunctivitis. The list also includes staphylococci, streptococci and saccharomycetes. Then there are others like the Koch-Weeks, Moran-Axenfeld, Petit's, Neden's bacilli and others which appear to be associated with eye disease alone.

In the beginning, an inflammation of the conjunctiva due to any of these causes may be indistinguishable from a beginning trachoma, but as time goes on we do not find in the case of any of these infections, the typical microscopical changes in the lymph follicles that we find in trachoma or the characteristic scarring to be seen where a trachoma has gone on to the scarring stage. Some at least of these known causes of conjunctivitis may produce destructive changes of the conjunctiva, but the tendency of all of them is after the subsidence of the inflammation to leave the conjunctiva practically as it was before, or at the worst leave a scarring readily distinguishable from that produced by trachoma. Besides trachoma we also have two well-recognized diseases which like trachoma are characterized by an overgrowth of connective tissue in conjunction with a proliferation of the sub-conjunctival lymphoid cells. These diseases are known, one as vernal conjunctivitis or Frühjahr catarrh, or more appropriately periodic hyperplastic conjunctivitis, and the other as Parinaud's conjunctivitis. Both may be easily mistaken clinically for trachoma. In fact, a diagnosis between vernal catarrh and a certain type of trachoma

often comes very nearly to being guess work. But in both these diseases the connective tissue and follicles disappear without undergoing scar formation, and leave the eyes just as they were before. A typical trachoma process always leaves its scars.

Again, it might be asked if the infection of trachoma always produces these typical follicular changes in the eyelid. As our knowledge of diseases in general has increased it has been constantly impressed upon us that we must reckon with atypical forms of various diseases. Cholera may exist without giving rise to typical symptoms. So also may diphtheria. The exceptional opportunities for clinical observation of inflammatory eye conditions furnished by our medical examination of immigrants have proved as conclusively as anything can be proved that a trachoma infection does not always produce the characteristic follicular changes and scar formation of a typical case of trachoma. Medical officers of my service have repeatedly seen a group of passengers arrive with an acute inflammation of the conjunctiva evidently due to infection from a case of trachoma with which they had been closely associated on ship-board. Of these some will make a perfect recovery with little or no medication and the rest will go on and develop typical trachoma in spite of treatment. Then, too, we not infrequently find a typical trachoma in one eye. Usually in such cases a careful examination of the apparently unaffected eye will disclose signs of conjunctival irritation or scarring from old trouble there. I don't remember that I ever saw a well-marked trachoma in one eye without finding some such evidence of trouble in the other, but would not be surprised if I did. Likewise, when we find a typical case of trachoma in a family that have all been living together, a careful examination of the eyes of the members of the family who have apparently escaped will usually reveal some conjunctival trouble, or signs of there having been such trouble. One especially interesting example of this sort that I recall was a family of Russian Germans, a father and mother and ten children with ages ranging from about 25 or 26 down to 10 or 12. This family presented every stage of trachoma from approaching blindness in the parents down to

a typical text-book plate case of trachoma in the youngest child. Among the children was a young woman 18 or 19 years old, whose eyes showed what appeared to be a slight conjunctivitis of a chronic character which was giving little practical trouble and which was free from any clinical evidence of trachoma whatever. If I had seen this young woman alone I would never have thought of calling the eye trouble trachoma. Of course it might not have been, but it seems to me far more probable that it was, and that this individual may have been just as capable of spreading the disease as any other member of the family. But this is merely of striking example of this sort. We find this nondescript chronic conjunctivitis so frequently in one member of a family, the others of which are suffering from typical trachoma or a typical trachoma in but one eye of an individual, as to leave no doubt in my own mind that the infective agent of trachoma is often carried by persons who do not present the usual clinical evidence of the disease.

Now, why is trachoma to be dreaded? Trachoma in its very beginning may quickly involve the ocular as well as the palpebral conjunctiva, become complicated with ulceration of the eyeball, and be rapidly followed by total blindness. There is reason to believe that this result may be due to the virulence of the initial trachoma infection alone, but probably it is more often due to a mixed infection. Our experience would lead us to believe that far more often trachoma comes on insidiously or with a comparatively mild initial inflammatory reaction. I believe that the reason why trachoma is generally regarded as a serious inflammatory affair at the beginning is due to the fact that this type of case tends early to seek medical treatment, while the ordinary case of a beginning trachoma does not. The dangers of trachoma to the individual are not, however, generally associated with its early stages, but are the indirect consequences of the pathological changes which take place in the sub-conjunctival lymph follicles. As a result of these changes the inner surface of the eyelids becomes more or less rough and irritates the eyeball, which is moreover kept in an abnormal condition by its maceration in the abnormal secretions. The ocular conjunctiva may become the seat of an actual

trachoma infection. Pannus is supposed to indicate such an infection. This abnormal condition of the eye renders it susceptible to superimposed infections of all sorts. I believe that the acute exacerbations which occur in the course of a trachoma are usually due to such mixed infections, aggravated perhaps by mechanical irritations from dust or smoke. Such acute exacerbations may be followed by corneal ulceration and partial or total destruction of vision at any time in the course of the disease. As the disease proceeds and the lymphoid follicles and conjunctiva are replaced by scar tissue, the eyelid becomes contracted and tightened, pressing its abnormal surface still harder against the eyeball. Furthermore, this same contraction may cause a turning in of the margin of the eyelid or entropion, which may bring the eyelashes directly against the eyeball. With this constant scraping of the cornea by the rough margin of the eyelid or the eyelashes a keratitis with steady impairment of the transparency of the cornea is inevitable. Now, as might be inferred from what has been said, an important factor in determining the results of a trachoma infection is the natural tightness or looseness of the individual's eyelids. We may and do find serious consequences to eyesight from corneal ulceration in persons with loose eyelids, but one may also find that a trachoma has run its course and completely destroyed the normal conjunctiva in a loose, flabby eyelid without causing trichiasis or appreciable damage to the cornea. There was slack enough in the eyelid to start with to keep the swollen lid from pressing seriously against the eyeball and to permit the subsequent scar tissue contraction also to take place without causing entropion or undue tightness of the lid. It is also in the loose lids that we are most likely to see spontaneous arrestation of the trachoma process. We often find in examining eyes of immigrants that they have had a trachoma which has destroyed a portion of the conjunctiva, giving rise to local scar tissue and contraction and then has stopped, leaving the rest of the conjunctiva practically normal. It is to be observed in this connection that marked improvement in a certain type of cases of trachoma often follows the dissection out and removal of the tarsal cartilage, apparently by the mere

fact of giving more slack to the eyelid and removing pressure against the eyeball.

As to the matter of treatment of trachoma: It is to be noted that the essential process of trachoma, the changes which take place in the sub-conjunctival lymphoid tissue, the formation of the follicles, their breaking down, the extrusion of their contents and the scar tissue formation are all very suggestive of an effort of nature to remove toxic material from the deeper sub-conjunctival tissue. It is also to be observed that the various forms of treatment appear to give results in proportion to the extent to which they favor the breaking down of the follicles and the liberation of material from the deeper tissues of the eyelids. In other words, such treatment is analogous in principle to the opening of an abscess with an attempt at disinfection. This rolling, scrubbing and scraping of the eyelids all tends to this end. It is also to be observed that the success which attends such treatment depends upon whether or not the disease has reached a stage at which the pathological process in connection with the follicles is tending to cease of itself. As for curing a case of trachoma, one might as well speak of curing a burn of the hand. It all depends on the actual conditions of the particular case. One might as well talk of restoring the function and normal appearance of a hand shriveled and contracted from a serious burn as to talk of curing a case of trachoma with the eyelid more or less adherent to the ocular conjunctiva, with a damaged cornea and with a disease process still going on up toward the retro-tarsal fold.

As to the contagiousness of trachoma: There is evidence suggesting the possibility of a positive immunity to the infection of trachoma. As in the case of some other diseases, a comparative immunity to trachoma has been ascribed to the negro race. I am inclined to think there is some basis for this belief, although I have seen bad cases of the disease in negroes. Very young children are believed to be immune to trachoma, and such apparent immunity is explained on the ground that sub-conjunctival lymphoid tissue does not usually appear in the eyelids of children before three years of age and that this tissue is essential to the development of the disease. As a matter of

fact, a practical immunity of young children to trachoma seems to be demonstrated by our experience with immigrants.

All attempts to inoculate the eyes of animals with trachoma have, so far as I know, proved unsuccessful. As might be expected, susceptibility to infection in human beings seems to be increased by irritation of the conjunctiva from any cause.

Without doubt trachoma is usually transmitted by direct contact, by the secretion from the eyes of an affected individual getting in the eyes of another person. The family towel and a common washing receptacle are undoubtedly the most usual means of spreading the disease. In New York City some years ago a sudden outbreak of trachoma was traced with practical certainty to the public baths. But trachoma infection cannot always be explained in this simple way. Certain European military surgeons maintain that experience with trachoma among soldiers indicates that the disease is spread by dust which may have been contaminated with the secretion from trachomatous eyes, just as pulmonary tuberculosis is spread.

A few years ago a prominent New York oculist told me that during the preceding six weeks he had had in his private practice eight cases of recent trachoma in well-to-do professional and business men, in which cases he could only account for infection by assuming the possibility of the disease being transmitted either by dust or by contaminated hanging straps in the street cars and trains.

It seems safe to assume that a case of trachoma begins to be a source of possible danger to others at least as soon as signs of inflammation are apparent. When it ceases to be contagious we do not know. Years ago a man who had made an extensive study of trachoma told me that he would not dare to have in his house as a servant a person who showed signs of ever having had trachoma, even the old parchment lids in which the conjunctiva had been replaced by scar tissue. I thought at the time that his view of this matter was extreme, but since then several cases have come to my own personal knowledge in which trachoma has occurred in children in well-to-do families where the evidence pointed to infection from a servant whose eyes showed only the scarring from a former compara-

tively mild trachoma process. I think that we must regard a person whose eyes thus show evidence of a trachoma process as a possible source of danger, and right here I want to make the point that it is entirely unjustifiable to regard a case of trachoma no longer dangerous simply because it has been under treatment until no more active trachoma granulations can be seen. Such treatment may have removed the clinical evidence of the disease, but that is all we can say for the time being. Usually we will see granulations appearing again within six months, calling for another period of treatment. But trachoma is undoubtedly most contagious in its earlier acute stages, and it seems entirely justifiable to assume for practical purposes the axiomatic principle that in trachoma or any other contagious eye affection the danger of contagion is directly proportionate to the amount of secretion which may be present at any time.

As to the diagnosis of trachoma: The diagnosis of a well-established typical case of trachoma presents no difficulty whatever. On everting the upper eyelids the nature of the disease will be recognized by anyone who ever saw a text-book picture of a trachomatous eyelid. A diagnosis can usually even be made from the appearance of the eyelid externally without touching it. It may also be observed in this connection that during the stage when the granulations are more conspicuous the eyeball is not likely to be inflamed or congested except on occasions of some acute exacerbation of the disease.

The diagnosis of a beginning case of trachoma or even of a long standing atypical case, is, however, a matter calling for special clinical experience. When, in 1897, the federal government made aliens afflicted with trachoma excludable from admission to the country, those of us engaged in the medical examination of immigrants were suddenly called on to make the differential diagnosis between trachoma and any other inflammatory conjunctival affection. We naturally looked for help wherever we could get it, and it was not long before we learned that the average oculist did not know trachoma when he saw it, chiefly because he was only familiar with the stage and type of the disease which showed up for treatment. We

also learned that the average oculist did not know where to look for earlier evidence of trachoma and that he would express an opinion about possible cases after merely everting the eyelid, without pressing down and exposing the superior cul-de-sac to view, yet it is here that typical trachoma granulations are always first to be found.

Since that day the number of people with eye inflammation that officers of the federal service to which I belong have held under observation as possible cases of trachoma run into the hundreds of thousands. We know that while trachoma may come on as a violent inflammatory affair, it more often comes on insidiously and for a longer or shorter period is indistinguishable from a conjunctivitis from any other cause. Resistance to palliative treatment is always suspicious, but the first positive evidence on which a diagnosis can be made is the demonstration of firm granulations, indicating that the hyperplastic changes are taking place in the follicles. The locality where this process is likely to be first demonstrable is in the retro-tarsal fold. The granulations may be big like a text-book plate of trachoma, or they be fine as pinheads and scattered along the conjunctiva at the upper margin of the tarsal cartilage. I am assuming that there is no marked general congestion and swelling of the eyelid. Such swelling may mask trachoma granulations, which will show up after the swelling has subsided. Demonstrable trachoma granulations may be expected to appear within two or three weeks of the initial conjunctivitis, but in one case that has impressed itself on my mind they did not appear until after five months of apparently a mild conjunctival irritation which resisted constant treatment.

Perhaps the most difficult problem likely to arise in connection with the diagnosis of trachoma is to distinguish beginning trachomatous granulations from an innocuous follicular conjunctivitis, that is from a simple overgrowth of the lymphoid tissue of the eyelid, a condition analogous to and usually a concomitant of adenoids in children. There are some cases of follicular conjunctivitis with pale, almost transparent follicles and no signs of inflammatory reaction, in which one can say imme-

diately that the condition is merely a follicular conjunctivitis. But often a differential diagnosis can only be made by waiting to see if some of the follicles change in appearance and exhibit a tendency to grow harder or break down and cicatrize. If so, it is a case of trachoma. It is not to be assumed that a case is follicular conjunctivitis and not trachoma simply because most of the follicles are typical of the innocuous follicular condition. Such soft, transparent follicles are always to be seen in a beginning case of trachoma after acute inflammation and swelling of the lid has subsided sufficiently to allow the overgrowth of the subconjunctival lymphoid tissue to be distinguished at all.

To summarize briefly the matter of the diagnosis of trachoma: Nobody can tell a beginning trachoma from a conjunctivitis due to many other causes, although the demonstration in abundance by the microscope of the pneumococcus or other bacteria known to be causes of conjunctivitis may make a diagnosis reasonably sure. A typical, well-established case of trachoma ought to be recognized clinically by anybody who has ever seen a case of the disease. Between these two extremes are more or less atypical manifestations of the disease in which a correct diagnosis must depend at present upon the examiner's personal experience with trachoma and the care which he takes in examining the eyelids. Yet, as is true of many other communicable diseases, the recognition of atypical manifestations of trachoma is essential to the success of any measures directed to the prevention of the spread of this disease.

TREATMENT OF TRACHOMA BY GRATTAGE.

By

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The extended course of the medical treatment of trachoma and the uncertainty of an eventual cure has led to the devising of various radical surgical procedures in the hope of attaining a more rapid and permanent cure. Among the earliest of these is grattage.

This operation has been extensively used in Europe for many years, but it has not been popular in America where the operation of expression of the granulations by means of the Knapp roller forceps has been preferred by ophthalmic surgeons.

Fox has recently called attention to the advantages to be derived from grattage in suitable cases of trachoma. The author has for the past two years performed this operation in a form slightly differing from that described by Fox and under local anesthesia, in cases of chronic benign trachoma, but it was not possible to keep the patients under observation. In the following series of cases however, the patients have been seen regularly a sufficient length of time to warrant accurate conclusions.

Patient 1. C. K. H., male, 18 years of age, Chinese.

History. Has had sore eyes for two years. Was treated one year ago with applications of copper sulphate and lids were at that time apparently freed of granulations.

Examination. O. D. Cornea has narrow band of vascularization at the upper limbus. The conjunctiva of the upper lid is covered with spawn like granulations extending over the tarsal and retro-tarsal fold. The conjunctiva of the lower lid is also studded with granulations. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation, January 27, 1914. The conjunctiva was anesthetized by three instillations of one drop each of a 2% solution of cocaine at intervals of five minutes. The upper lid was then seized along the ciliary border with long hemostatic forceps and

everted by rolling it on itself. (The damage done to the lid by this procedure is very slight and all traces of it usually disappear at the end of twenty-four hours.) A rubber spatula was then put over the globe to protect it from injury. The conjunctiva was then incised in rows parallel and at right angles to the margin of the lid with incisions about two m.m. apart (gridiron), and then the conjunctiva was thoroughly scrubbed with gauze spread over the index finger until a smooth surface was left. A stream of boric acid solution was played over the field during the operation. After the lids were smooth a crystal of copper sulphate was rubbed over the raw surface and the excess washed off with boric acid solution. The lower lid was treated in the same manner. The same operation was done on both eyes. This procedure destroys the disease conjunctiva.

After the operation cold compresses were immediately applied and kept on for two hours at the hospital, but as the patient did not wish to be kept at the hospital and as he lived at a distance of only five minutes ride, he was sent home with instructions to keep an ice bag over both eyes continuously and he was given an eye lotion of boric acid to be used every two hours.

When seen the next day, the eyelids were greatly swollen and both corneæ were white. Vision was reduced to shadows. When asked whether he had followed instructions, the patient said that he had not applied anything to his eyes since leaving the hospital. The seriousness of his condition was impressed upon the parents and he was taken to the hospital where ice was continuously applied for four days and atropin solution instilled one drop in each eye three times a day. The lids were separated and cleansed with boric acid solution every two hours. Under this treatment the swelling subsided, the cornea gradually cleared, and at the end of four days the ice was discontinued and only a solution of atropin, two grains to the ounce, and a 5% solution of dionin were instilled, one drop of each three times a day.

Present Condition. O. D. Cornea has a faint opacity near center. Conjunctiva of upper lid scarred over, but in places there are fine granulations beginning to show. Conjunctiva of lower lid white and smooth; blood vessels clearly seen; no granulations. O. S. about the same as O. D.

Vision O. D. $\frac{20}{40}$ with -1 sphere = $\frac{20}{20}$

O. S. vision $\frac{20}{40}$ with -1 sphere = $\frac{20}{20}$

Patient 2. Y. K., male, 20 years of age, Chinese. Cousin to above case and living in the same house.

History. Has had sore eyes for two years.

Examination. O. D. Cornea has narrow band of vascularization at upper limbus. Conjunctiva of upper lid is covered with granulations extending over the tarsal and retro-tarsal folds. The conjunctiva of lower lid is covered with granulations. O. S. same as O. D.

Diagnosis. Follicular trachoma.

The same operation was done on the same day and with the same results on this patient. He had the same complications and the same after treatment and the same results.

I describe these two cases first, as they illustrate the great danger of leaving any portion of the treatment to the patient. These two Chinese boys are intelligent and yet they neglected to follow instructions with the result that they developed serious corneal complications.

The cause of the reinfection with trachoma of both these cases may be attributed to the fact that there are four more members of the family affected with trachoma with whom these boys are thrown into intimate contact.

Patient 3. P. F., female, 18 years of age, Filipino.

History. Has had sore eyes for a number of years.

Examination showed the tarsal and retro-tarsal folds of the conjunctivae of both eyes covered with spawn-like granulations. The lower lids were also involved.

Diagnosis. Follicular trachoma.

Operation January 27, 1914. Same as above. When seen the next day, the right lids were not much swollen and the cornea was clear. The left lids were more swollen and the cornea was hazy. Patient said that she had not kept the ice on her eyes after she went to sleep the evening after the operation. She was

admitted to the hospital, ice was put on and atropin instilled into left eye. She was discharged after three days.

Present Condition. O. D. cornea clear. Upper and lower lids white, smooth and well cicatrized. Blood vessels clearly defined. No discharge. O. S. Cornea clear. Upper and lower lids white and smooth. Blood vessels clearly defined. No discharge.

Patient 4. M. D., male, 20 years of age, Filipino.

History. Has had sore eyes for many years. One year ago had lids treated with copper sulphate.

Examination. O. D. tarsal and retro-tarsal folds of the conjunctiva of upper lid studded with granulations; lines of cicatricial tissue in conjunctiva. Conjunctiva of the lower lid covered with granulations. O. S. same as O. D.

Diagnosis. Chronic trachoma.

Operation January 27, 1914. Same as in previous cases. When seen next day the cornea of the right eye was cloudy. The left cornea was clear. When questioned patient admitted that during the night cold compresses were not applied. He was placed under the same treatment as the previous cases, and the cornea cleared up entirely at the end of two weeks.

Present Condition. O. D. lids smooth but there are still areas of reddish limphoid tissue interspersed between the white cicatricial tissue. Blood vessels are clearly defined; cornea clear; no discharge. O. S. same as O. D.

Patient 5. J. A., male, 16 years of age, Filipino.

History. Has had sore eyes for the past year.

Examination showed the entire conjunctiva of the upper and lower lids of both eyes covered with large soft and pale spawn-like granulations.

Diagnosis. Follicular trachoma.

Operation February 4, 1914. The same as in above cases. Patient was not sent home but admitted to the hospital where an ice bag was kept on the eyes day and night and the eyes were irrigated every two hours with a solution of boric acid for forty-eight hours. The white scum which forms over the area of operation was removed as it formed and the lids were opened from time to time to prevent adhesions. Under this treatment

there was but little swelling of the lids after twenty-four hours. The cornea remained clear and after forty-eight hours the patient was discharged and treated daily at the out-patient department. His lids healed nicely and were well on the way to complete cicatrization when on February 25, 1914, he returned to the out-patient department with both eyes much congested, photophobia, muco-purulent discharge and the conjunctiva again covered with fine granulations. He was treated with boroglyceride of glycerin 30% applied once daily and an eye lotion instilled three times daily.

Present Condition. O. D. eye quiet. Conjunctiva of both lids covered with fine granulations between areas of scar tissue. O. S. same as O. D. This patient has two members of his family suffering with trachoma and he undoubtedly became reinfected from them.

Patient 6. Z. C., male, 20 years of age, Filipino.

History. Has had sore eyes for about two years.

Examination showed O. D. the conjunctiva of both lids covered with granulations interspersed between areas of scar tissue. A narrow band of vascularization over the upper limbus of the cornea. O. S. same condition.

Diagnosis. Chronic trachoma.

Operation February 4, 1914. Same as in above cases. Same treatment in hospital. The next day the lids were swollen, but the cornea was clear in each eye. Patient was discharged at the end of 72 hours, and has returned daily to the out-patient department for treatment and observation.

Present Condition. O. D. upper and lower lids smooth and white. Blood vessels clearly defined. No discharge. Cornea clear. O. S. same as O. D.

Patient 7. P. C., female, 12 years of age, Filipino.

History. Sore eyes for the past year.

Examination. O. D. the tarsal and retro-tarsal folds of upper lid covered with granulations. The lower lid also covered with granulations. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation February 4, 1914. Ether anaesthesia. Same operation as above. Same treatment. Next day the left cornea was cloudy, lids much swollen. The right cornea was clear. Under atropine and boric acid treatment the cornea cleared up in ten days, when patient was discharged. She was kept under observation, like all the rest, in the out-patient department.

Present Condition. O. D. conjunctiva smooth and white. Blood vessels clearly defined. No discharge. Cornea clear. O. S. same as O. D.

The cause of the corneal involvement in this case may have been due to the fact that during the night the ice bag slipped off the left eye as the patient was lying on her right side. It emphasizes the fact that after grattage a nurse should be in constant attendance on the patient for the first twenty-four hours.

Patient 8. A. J., male, 17 years of age, Filipino.

History. Has had sore eyes for two years.

Examination. O. D. tarsal and retro-tarsal folds of conjunctiva covered with soft, pale spawn-like granulations. Lower lid also covered with granulations. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation February 8, 1914. Under chloroform anaesthesia the same operation was performed as was described above. The after treatment was the same. Next day the lids were slightly swollen and both corneae were clear. Patient was discharged at the end of 72 hours to the out-patient department, where he has returned daily for treatment and observation.

Present Condition. O. D. lids smooth and white. Blood vessels clearly defined. No discharge. Cornea clear. O. S. same as O. D.

Patient 9. M. de la P., male, 16 years of age, Spaniard.

History. Has had sore eyes for more than a year.

Examination. O. D. tarsal and retro-tarsal folds of conjunctiva covered with pale, soft, spawn-like granulations. The lower lid similarly affected. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation February 8, 1914. Chloroform anaesthesia. Same operation as that described above, except that the sulphate of

copper was not used after the scrubbing process. Same after treatment. No complications occurred, and the patient was discharged to the out-patient department after 72 hours. He has continued coming daily for treatment and observation.

Present Condition. O. D. lids smooth and white, with blood vessels clearly defined; no discharge; cornea clear. A narrow thin band of adhesion between the outer lower portion of the ocular conjunctiva and the conjunctiva of the lower lid, which does not interfere with the movements of the eyeball. O. S. same as O. D., but no adhesions.

Patient 10. C. C., male, 19 years of age, Filipino.

History. Has had sore eyes for a long time; does not remember how long.

Examination. O. D. tarsal and retro-tarsal folds of the conjunctiva covered with pale spawn-like granulations. The lower lid also involved. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation February 8, 1914. Chloroform anaesthesia. Same operation and after treatment as Patient 9. No complications. Patient was discharged to out-patient department after 72 hours, for daily treatment and observation.

Present Condition. O. D. upper and lower lids smooth and white; blood vessels clearly seen; no discharge. O. S. same as O. D.

Patient 11. I. H., female, 16 years of age, Filipino.

History. Has had sore eyes since childhood and imperfect vision for the last three years. During the last year her vision has rapidly deteriorated until now she cannot count fingers with either eye at a greater distance than 4 feet.

Examination. O. D. marked photophobia; purulent discharge; marked entropion of lower lid, so that eyelashes rest on the cornea. Pericorneal injection. Pannus of medium density covers entire cornea. Lids very much thickened and cannot be everted. O. S. same as O. D.

Diagnosis. Chronic malignant trachoma with pannus and entropion.

Operation February 11, 1914. Under chloroform anaesthesia

the lids were easily everted by means of the forceps as described above. The exposed conjunctiva was very red and covered with tough red granulations, and areas of scar tissue. The same operation was done and the same after treatment employed as in case of Patient 9. After 24 hours the lids were much swollen but the cornea remained unchanged. The swelling of the lids subsided after three days, but there was no change in the condition of the cornea. Under atropine 2% and dionin 5% solution one drop three times a day the pannus gradually began to disappear from the center of the cornea. The entropion persisted and after seven days in the hospital an operation for the cure of the entropion was suggested but refused by the patient. She was then discharged from the hospital and returned only occasionally for treatment and observation.

Present Condition. O. D. upper and lower lids smooth but very thick; eye watery; entropion of lower lid, lashes resting on cornea; cornea clear over pupillary area, but pannus above and below this space. Photophobia not marked; vision much improved. O. S. same as O. D. Patient can see to do ordinary work.

Patient 12. K. T., male, 29 years of age, Chinese.

History. Has had sore eyes for many years.

Examination. O. D. photophobia, purulent discharge, pericorneal injection; cornea hazy and has numerous small round superficial ulcers. Conjunctiva shows bands of cicatricial tissue and between these there are many red granulations. The retrotarsal fold contains more granulations than the tarsal fold. Lower lid has bands of cicatricial tissue and granulations. O. S. same as O. D.

Diagnosis. Chronic malignant trachoma.

Operation February 11, 1914. Under chloroform anaesthesia the same operation was done and the same after treatment employed as in case of Patient 9. After 24 hours the lids were moderately swollen, but there were no corneal complications. Patient was discharge to out-patient department at the end of 72 hours and has been under daily treatment of 30% boroglyceride application.

Present Condition. O. D. numerous small white leukomas of cornea, the sites of previous ulcers; otherwise cornea normal. Upper and lower lids are smooth and thick, but there are large areas of reddish lymphoid tissue between the areas of white scar tissue. There is no discharge. O. S. same as O. D.

Patient 13. J. C., male, 17 years of age, Chinese.

History. Has had sore eyes for the past two years.

Examination. O. D. lids thickened and drooping. Tarsal and retro-tarsal folds of conjunctiva covered with large firm granulations. Lower lid also involved. O. S. same as O. D.

Diagnosis. Chronic trachoma.

Operation February 14, 1914. Under ether anesthesia the same operation was done as in the previous case except that a tooth brush was used for scrubbing instead of gauze and bichloride solution 1-1000 was used to flush the field of operation. The after treatment consisted of the continuous application of ice and irrigation of the eyes with 1-2000 bichloride solution. The next morning the right eyelids were enormously swollen; chemosis was present and the cornea was cloudy. The left eye was not so much swollen as the right and the cornea was clear. Atropin was instilled into the right eye. An ice bag was kept on for 72 hours when the swelling subsided. At the end of five days the patient was discharged from the hospital. He is now coming to the out-patient department daily for treatment.

Present Condition. O. D. cornea clear except for a small linear opacity to the outer margin of the pupil. The conjunctiva shows bands of scar tissue with granulations between. O. S. cornea clear; conjunctiva of upper lid shows areas of scar tissue with lymphoid tissue between.

This patient has consented to a second operation in the near future.

Patient 14. P. A., male, 18 years of age, Filipino.

History. Has had sore eyes for the past year.

Examination. O. D. tarsal and retro-tarsal folds of the conjunctiva covered with granulations. Lower lid also involved. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation February 16, 1914. Under ether anesthesia same procedure with same after treatment was employed as in case of Patient 13. No complications developed. Patient was discharged to out-patient department at the end of 72 hours.

Present Condition. Upper and lower lids of O. D. smooth and white; no discharge; blood vessels clearly seen. O. S. same as O. D.

Patient 15. J. D., male, 15 years of age, Filipino.

History. Has had sore eyes for the past year.

Examination. O. D. conjunctiva of tarsal and retro-tarsal folds covered with pale spawn-like granulations. Lower lid also involved. O. S. conjunctiva contains fewer granulations than O. D.

Diagnosis. Follicular trachoma.

Operation February 16, 1914. Same as in case of Patient 13, with same after treatment. No complications developed. Discharged to out-patient department at the end of 72 hours.

Present Condition. O. D. upper and lower lids white and smooth; blood vessels clearly seen; no discharge. O. S. same as O. D.

Patient 16. G. G., male, 17 years of age, Filipino.

History. Eyes have been sore for more than one year.

Examination. O. D. tarsal and retro-tarsal folds of conjunctiva covered with pale spawn-like granulations. Lower lid is also affected. O. S. same as O. D.

Diagnosis. Follicular trachoma.

Operation March 8, 1914. Same in every respect as that of Patient 13. No complications developed. Patient was discharged 72 hours after operation.

Present Condition. O. D. upper and lower lids smooth and white; blood vessels clearly seen; no discharge. O. S. same as O. D.

In making a resume of the results of grattage in this series of cases it is important to discuss the question as to when a case of trachoma may be considered cured. Since the granulations of trachoma consist of lymphoid tissue and are a proliferation of the normal lymphoid tissue of the conjunctiva, it seems reason-

able to assume that when the lymphoid tissue has been destroyed, there can no longer be any trachoma. The destruction of the lymphoid tissue is manifested by the smooth white, fibrous surface of the lid and the clearly outlined blood vessels on the conjunctiva.

The nine cases in which this result was obtained and the discharge ceased may be considered cured. The two cases in which the lids are smooth and there is no discharge but in which the conjunctiva shows white areas of scar tissue mixed in with reddish areas of lymphoid tissue may be considered quiescent and non-contagious. They are, however, liable to reinfection and relapse. The two cases in which the symptoms were abated may be considered improved. The other three cases were not improved. In a number of the quiescent, improved and not improved cases, a second or a third grattage may effect a permanent cure.

Table.

Patient—	Cured.	Quiescent.	Improved.	Not Imp.
1.....	....	....	....	1
2.....	....	....	....	1
3.....	1	....	....	....
4.....	....	1	....	....
5.....	....	....	....	1
6.....	1	....	....	....
7.....	1	....	....	....
8.....	1	....	....	....
9.....	1	....	....	....
10.....	1	....	....	....
11.....	....	....	1	....
12.....	....	1	....	....
13.....	....	....	1	....
14.....	1	....	....	....
15.....	1	....	....	....
16.....	1	....	....	....
Total.....	9	2	2	3

Precautions to be Observed in Doing Grattage.

It is better to use a general anesthetic, as cocain may have a tendency to produce ulceration by its action on the corneal

epithelium. A rubber or horn spatula should be held over the eyeball to prevent its being injured during the scrubbing process.

The scrubbing must be thoroughly done so that the lymphoid tissue is entirely destroyed. After the operation an ice bag must be continuously applied night and day. It is best to have the ice bag tied over the eyes, and a nurse to watch so that it is not displaced during sleep. Despite the ice bag corneal opacities may result in patients with narrow commissures, as in the eyes of Orientals. These corneal opacities result from the blocking of the lymph supply of the cornea by the swollen conjunctiva. To relieve it and prevent a sloughing of the cornea, a canthotomy may be necessary in serious cases, but the swelling usually subsides under atropin and an ice bag. Symblepharon is avoided by opening the lids and gently wiping away the secretions every two or three hours during the first 48 hours after the operation.

Conclusions.

Grattage properly done greatly shortens the period required to cure trachoma.

One operation effects a cure in about 50% of cases.

Repeated operations effect even a greater percentage of cures.

Patients who have had grattage done should be kept under close observation at a hospital until all danger of complications is over. They should not be sent home until the lids are entirely healed and cicatrized because the unhealed surface may be reinfected by contact with other members of the family having trachoma.

Grattage by removing the granulations of trachoma and the underlying lymphoid tissue is a more rational surgical treatment of trachoma than simple expression of the granulations.

NEWS AND COMMENT

There was established at Hamburg, Germany, on May 28, a new institute of ship and tropical diseases.

Dr. James M. Anders has been appointed a member of the Philadelphia Board of Health. He succeeds Dr. Charles H. Andrus.

Two hundred thousand dollars has been granted by the House of Representatives to fight rats and squirrels in California.

The Association of Promoting Hygiene and Public Baths elected Dr. Simon Baruch president at its last meeting in Newark, May 12-13.

Ten cases of tropical dysentery, in three families, are reported from Chattanooga, Tennessee. The Shiga bacillus was found upon investigation.

The disease, first thought to be bubonic plague, which appeared at Columbian ports has been investigated by Dr. Samuel T. Darling and found to be pneumonia.

A seven-day quarantine was recently declared by the Canal Zone health authorities against all Columbian ports, owing to the serious aspect of the plague situation

The eugenics laws of Wisconsin has again been in court. This time the Supreme Court has reversed the decision of the lower court and has sustained the law.

The *Ligue sanitaire française contre la mouche et le rat* has been founded in France to destroy rats, fleas, flies and all other disease-carrying vermin in the country.

Dr. M. J. Rosenau, professor of preventive medicine and hygiene at the Harvard Medical School, was given the honorary degree of Master of Arts by Harvard University on June 18.

The honorary degree of D. Sc. has been conferred upon Surgeon-General Gorgas by Princeton University, and the honorary degree of LL. D. has been conferred upon him by Yale University.

At a meeting of the Association of Life Insurance Presidents in New York on June 5, Dr. Louis I. Dublin estimated that \$1,000,000,000 was annually lost through preventable diseases by the United States.

Blood smears from over two hundred children of the Shreveport, Louisiana, high schools were examined and not a single malaria parasite found. The examinations were made by officers of the U. S. Public Health Service.

A new department of hygiene and bacteriology has been established at the University of Chicago. Dr. Edward O. Jordan at its head and associated with him are Dr. Norman MacLeod Harris and Dr. Paul G. Heinemann.

One meeting of the alienists and neurologists, in session in Chicago from July 14 to 18, will be especially for the public and the prevention of insanity and the cause of mental deficiency will be discussed.

There is a model dairy in connection with the Otisville Sanitarium, Otisville, N. Y. Highest grade tuberculin-tested Holsteins are kept and the milk is tested each week in the bacteriological laboratory of the sanitarium.

An honorary degree of doctor of science was given Dr. Aristides Agramonte, professor of bacteriology and experimental pathology of the University of Havana, at the 160th commencement of Columbia University held last month.

A small sum has been appropriated by the Philippine Legislature for the preparation and distribution of an extract of rice polishings, with the hope that it will to some extent reduce the prevalence of beriberi, especially among children.

A committee has recently been appointed by President Butler of Columbia University, to study public health work, preventive medicine and sanitary science, and decide what courses should be introduced into the different departments of the University.

A gift of \$400,000 has been received by the Yale Medical School from the relatives of the late Mrs. George Lauder to establish a memorial to be known as the Anna M. R. Lauder Fund. The only stipulation is that a chair of public health be founded.

A novel fly-catching contest has been started in Philadelphia. The contest is only open to boy scouts and the prize has been offered for the one handing in the greatest number of dead flies. Each troopmaster will be the judge of the boys in his troop.

Dr. Edmund O. Sawyer, health officer of the Los Angeles County, California, is strongly advocating the selection of San Clementi Island as the site for the proposed national leprosarium.

Five thousand dollars has been asked for by the health officer of Montreal with which to put the health department on a more substantial footing. A civil laboratory for food inspection, etc., will be established, and qualified food and sanitary inspectors will be appointed.

The Panama Canal should have a good influence on the health conditions of the surrounding countries, since no boats from infected ports will be allowed to pass through the Canal, so unless authorities in these places clean them up they will be unable to enjoy the great benefit of the short cut.

The city council of Wilmington, N. C. has considered reducing the appropriation for the city health department below that agreed upon by the municipal health officers and the county commissioner. A meeting of five hundred citizens was held on June 2 to ask the council to reconsider this action.

The antivaccination bill was defeated in the Massachusetts House of Representatives recently with a vote of 133 to 53. The bill had formerly been passed by the Senate with a vote of 25 to 9. Dr. E. H. Bigelow made the principal speech and exhibited pictures showing the effects of smallpox.

The Bureau of Public Education has recently been inaugurated by the New York City Department of Health, to teach the general public more about public and personal hygiene. Dr. Charles Bolduan has been put in charge. The Bureau is now reaching the people through the moving picture shows.

The board of regents of the University of California has chosen Dr. George Hoyt Whipple director of the Hooper Foundation for Medical Research, established last year by the gift of a million dollars to the University. Dr. Whipple was at the Ancon Hospital, Panama Canal Zone, for some time and is now association professor in Johns Hopkins University.

According to the *Medical Record*, Major E. L. Munson is doing good work in the Moro Province by opening up dispensaries throughout the country, in which work he has the assistance of a number of church denominations, who are also opening dispensaries. It is believed that more can be done by giving the natives medical aid and instilling confidence in them than could ever be accomplished by any number of soldiers sent into the country.

Following the announcement in several newspapers of New York of deaths or illness caused by antityphoid vaccination, Health Commissioner S. S. Goldwater caused an investigation to be made. One case was that of a private in the National Guard of Brooklyn, who was stated to have died as a result of

an injection of antityphoid vaccine. In none of the reported cases was death found to be attributable to the vaccine.

Of the 165 cases of tuberculosis rejected from the Otisville Sanitarium, 66 were negative sputum upon repeated examinations. The other 99 cases were positive sputum, but were too far advanced to be admitted to Otisville, but were advised to enter other hospitals. It was found however, that only 62 did enter hospitals, the remaining 37 returning home or spending their time lounging on park benches or in other public places, thus becoming 37 actual and known disseminators of tuberculosis.

Past Assistant Surgeon A. D. Foster, U. S. P. H. S., has recently issued a communication upon the manner of disinfecting railroadcars used by the Pullman Company and the Southern Railroad Company at Asheville, N. C. Since thousands of tuberculosis patients are carried to and from Asheville and the surrounding country, the place is well chosen. The cars are disinfected with formaldehyde gas, followed by a thorough cleansing with soap and water, compressed air and live steam. Everything movable is put outside in the sun and air. Water-tanks, spittoons, everything movable and immovable, receive their full share of the cleaning.

Six cases of bubonic plague have been discovered in New Orleans, four proving fatal. Upon the discovery of the first case, local and state authorities immediately set about planning a thorough clean-up campaign. Surgeon-General Rupert Blue, assisted by Surgeon R. H. Creel and others, have arrived in New Orleans and taken charge of the situation. Though there is little danger at present of an epidemic occurring, every precaution is being taken and the campaign carried on will be similar to that in San Francisco in 1907. No quarantine will be instituted in New Orleans or in the surrounding country, as those in charge feel that under the circumstances such a step is quite unnecessary.

A new journal has been started entitled the *Journal of Parasitology*. This field is one that has for some time been open to such a publication and the new journal should receive a hearty welcome among the many now interested in the growing subject. A look at the names on the editorial board is enough to assure one of its success. They are Franklin D. Barker, University of Nebraska; Charles F. Craig, Medical Corps, U. S. A.; William B. Herms, University of California; Brayton H. Ransom, U. S. Bureau of industry; William A. Riley, Cornell University; Allen J. Smith, University of Pennsylvania; John W. Scott, University of Wyoming; Charles W. Stiles, U. S. Public Health Service; Richard P. Strong, Harvard University; John L. Todd, McGill University; Robert T. Young, University of North Dakota; Henry B. Ward, University of Illinois.

A special committee of the General Education Board has for some time had under advisement the establishment of schools for the training of public health officers. On May 29 the committee reported that owing to the fact that no such schools were at present in existence, they were of the opinion that schools for this purpose should be started in connection with the medical and engineering departments of universities, and in coöperation with the boards of health, in at least two cities, probably New York and Boston. Such a course as that contemplated by this committee has been given for the past three years in the School of Hygiene of Tulane University, the degree of Dr. P. H. being awarded at the completion of the course. The University of Pennsylvania and Harvard University also have courses leading to the degree of Doctor of Public Health.

Public Health Activity.

MASSACHUSETTS.—(Annual Report of the Board of Health of the City of Lynn.) During the last year the restaurants, hotels, markets, and all eating places have received their full share of the attention of the Board of Health of Lynn. All lunch carts have been required to install a sink and running water, with proper sewer connection, a long-needed convenience. The Inspector of Licenses, for several months past, has turned

over to the Board of Health all petitions for victuallers' licenses for the approval of the sanitary condition of the premises before such petitions have been granted.

MISSOURI.—Kansas City, April, 1914. Owing to the prevalence of smallpox in Kansas City for the last few months, it has been decided that instead of caring for patients in the General Hospital, and thus putting a heavy burden on the taxpayers, they will hereafter be isolated in their own homes, except in cases where this would seem impracticable, and the houses placarded. Exceptions will be made only when patients are living in boarding houses, lodging houses, hotels, etc. The attitude taken by the Board of Health is that everyone should be vaccinated, those unable to afford it being given free attention at the General Hospital. The board does not compel vaccination, but it has given the warning and those who are heedless of it and contract the disease should not be made a burden to the taxpayer, but should be made to bear the responsibility of their own heedlessness.

INDIANA.—Monthly Bulletin of the State Board of Health, April, 1914. According to this bulletin, the U. S. Department of Agriculture some years ago attempted to prevent the Indiana Board of Health from enforcing laws regulating and prohibiting the use of food preservatives. The department is now, however, doing much toward this very step. The head of a large drug concern states that people living in Virginia, North and South Carolina, Tennessee, Georgia and Kentucky, especially in the rural districts, have for years purchased large quantities of salicylic acid in one-fourth-pound packages. It is true that this does prevent decay, but the slight benefit derived is far overshadowed by the harm done. Less care is used and cleanliness is not considered of sufficient importance. Then there is the danger from the continued and too free use of such an acid, often causing a severe derangement of the digestive system.

NEW YORK.—Buffalo Sanitary Bulletin, May, 1914. Under the head "Milk and Public Health," the statement is made that

two hundred thousand children die in the United States before reaching their first year, and 40 per cent of these deaths are attributable to poor milk. And yet parents go along their way blissfully (?) oblivious of this, and blame the death of their babies on hot weather, Fate, or some other cause. And when told of the dangers lurking in milk, what do they call their instructors? "Cranks." When will parents heed the warning and take steps that will mean the saving of their babies' lives?

OHIO.—Monthly Bulletin of the State Board of Health, June, 1914. Dayton has a new system of public health nursing. All nurses of the division of health, the nurses of the Tuberculosis Society, and those of the Visiting Nurses Association, have been organized and put under one management. A large tuberculosis clinic is in operation and patients are taught to present themselves for examination every two weeks, that accurate account may be kept of their weight and physical condition. Members of families in which there is a tuberculous patient are also urged to attend the clinic, and also all patients having a suspicious history, symptoms or signs, in order that cases may be discovered in their incipency. In its work of thus hunting out the new cases, while there is yet good hope of recovery, the clinic is practicing preventive medicine in its truest sense.

CURRENT LITERATURE

RESEARCHES ON SPRUE. — (Transactions of the Society of Trop. Med. and Hygiene, April, 1914, Vol. VII, No. 5.) Bahr, in a lengthy report, ably discussed by Cantlie, Low, Hartigan, Wedd, Beddoes and Bassett-Smith, offers in brief the conclusions arrived at after two years' labor in research on this interesting and equally important affection mostly confined to the Tropics, but appearing as sporadic cases in temperate regions sufficiently often to justify some consideration as to a possible etiologic factor. The researches were conducted in Ceylon, where it is exceedingly common—more common, in fact, than in most other places, according to the number of cases reported. The disease, while of native origin, attacks Europeans more than natives, and some attacks do not manifest themselves until the European returns home. The disease usually occurs as a primary specific infection, no predisposing affection being necessary for its propagation, although certain debilitating diseases predispose, owing to the lowered vitality which is common to all diseases. Its infectious nature is still under discussion, but authentic cases have been reported, leaving the question still open. The symptomatology the author divides into two classes, "typical or complete sprue," which includes the two cardinal symptoms—the characteristic tongue and stools, and "incomplete sprue,"—the diarrhea is typical, but the buccal symptoms and signs are absent; only advanced cases show the anemia which resembles the pernicious variety, but without the typical megablasts. The etiology is as yet very uncertain, though the suggestion of a possible blastomycosis meets with success and in some cases can hardly be doubted. Certain instances seem to point to the condition as an alimentary toxemia, others show a complete absence or inefficiency of the digestive ferments of the intestines. The thrush fungus (*Monalia albicans*) seems to bear the brunt of the attack, for the results of research are convincing in a sufficient number of instances to justify the implication of the organism.

P. L. Querens.

ON THE VITALITY OF THE CHOLERA VIBRIO OUTSIDE THE HUMAN BODY.—(*Indian Jour. of Med. Research*, Vol. 1, No. 3.) Greig, on studying the vitality of the cholera vibrio in human feces, vastly increases our knowledge of this important subject, for the excreta soon become free of the organisms, losing their infectious nature in from two to fourteen days, and usually less. The vibrios are soon outgrown by the other organisms present, mostly *Bacillus coli*, and perish, thereby marking this excrementitious matter free and absolutely negative as a source of infection. The results are absolutely reliable, for ninety-four examinations were made, which is a sufficient number to establish a definite conclusion. The temperature has a decided effect on their vitality, for during the hot months, especially June, their existence is greatly lessened, while during the cold season—December to February—the duration of life is greater. Deducting conclusions from the above researches, man, the “carrier,” is more deserving of attention than the excretions of cholera patients, for chronic “carriers” continue to cast off unsuspected infectious matter, and a large percentage of “carriers” are the output of every epidemic of cholera. One chart and five tables accompany the article.

P. L. Q.

COLLOIDAL COPPER AND MERCURY IN THE TREATMENT OF INOPERATIVE CARCINOMA.—(*Manhattan Eye, Ear and Throat Reports*, February, 1914.) Drs. C. J. Imperatore and Harmon Smith report two cases of inoperable cancer of the larynx and tongue treated with intravenous injections of colloidal mercury and copper. The medicaments were prepared by Dr. Silas P. Beebe, of the Loomis Laboratory. The first case was an iron-worker, aged 45 years. Family history negative as regards cancer. He had had syphilis twenty-nine years previously, for which he had been treated only a short time. He had been an inveterate pipe smoker and a heavy drinker. About two years before coming to the hospital, he had noticed a slight thickening on the right margin of the tongue, which gradually extended until it involved the entire tongue. In eight months he lost over thirty-four pounds in weight. When first seen by the authors, the tongue protruded slightly from the mouth and was

fixed. On the right side there was a mass of stony hardness. The superficial and deep cervical glands were involved. The diagnosis was confirmed by the microscope. Daily intravenous injections of colloidal copper were made, beginning with 15 c. c.; the dose was increased daily until 500 c. c. were given at the twenty-fifth dose, which was the last. After a rest of three weeks, they began to use colloidal mercury, 5 c. c. of which were injected into the tumor; this was repeated two days after. The patient declined any further treatment, and returned home, where he died in about two months. The second case was a carpenter of 64 years, who about 6 months before admission began to be husky and have difficulty in swallowing. On examination, he was found to have an epithelioma of the base of the tongue, epiglottis and larynx. Thirty c. c. of colloidal mercury were injected intravenously. Fifty c. c. were afterwards injected every day until the tenth injection, when the dose was increased to 100 c. c. Then the injections were given every second day, because the patient showed signs of salivation. The salivation was marked after the sixteenth injection, when the treatment was discontinued. The growth also had an unfavorable appearance. On admission his urine was free from albumin; in the later stages of the case there was a gram and a half of albumin to the liter of urine, with granular and hyalin casts. It is reasonable to infer that the injections brought about the renal disturbances. In the course of time, opiates were necessary to procure rest. The patient died nearly two months after being first seen.

Conclusions.—In the case of cancer of the tongue, the injection of the copper solution seemed to stay the growth for a period of a few weeks, but rapid disintegration of the mass soon after they were discontinued leads one to doubt if the solution was the cause of the retardation of the tumor, or if, perchance, it was one of those non-progressive periods that occur in cancerous growths in which the ravages of the disease seem to be temporarily stayed. The colloidal mercury seemed to have no effect on the tumor whatsoever. As regards lessening of the

pain, or increasing the functions of the part, no benefit can be said to have been derived from the colloids.

A. McShane.

ANGIO-NEUROTIC EDEMA OF THE RESPIRATORY TRACT.—(*Archivos de la Sociedad de Estudios Clinicos*, Havana, April, 1914.) Dr. Emilia Martinez reports two cases of angio-neurotic edema, or Quincke's disease. Although the disease is very rare, it is still likely to be encountered by any practitioner, who should be ever on the alert. The disease is characterized by localized serous infiltrations of the skin and mucosae, which appear brusquely and at varying intervals, without fever or pain, and disappear in a few hours. The etiology is involved in obscurity. It has been attributed to a hereditary vasomotor neurosis; to various infectious processes; to alcohol and different alimentary or toxic materials; to medicinal substances; and, finally, it has been ascribed to anaphylaxis. It often occurs either simultaneously or alternately with urticaria, and some authors have endeavored to correlate it with purpura. Dr. Martinez's first case was a lady of 54, who gave the following family history: her mother was still living; her father died of locomotor ataxia; three brothers died of phthisis and one of ataxia; she has never had any children. She had had three attacks of renal colic and one of hepatic colic. Six years before, she had an attack of typhoid fever, which was complicated with pulmonary edema with its attendant asphyxia, so that it became necessary to administer oxygen. One year later, while returning from a promenade, she had an attack of sneezing, accompanied by edema of the eyelids, naso-pharynx, velum palati and tongue, followed by an outbreak of generalized urticaria. The attack lasted nearly two hours. From that time on, the attacks came on frequently and always with intensity. The ingestion of alcohol in any form brought on an attack, especially in the form of champagne and spirituous liquors. In the last few months, sugar was found in the urine. Dr. Martinez put the patient on an anti-parthritic diet, and ordered alkaline waters. She has enjoyed good health ever since. The second case was a man of 37, who gave the following history: on Feb-

ruary 23, 1914, he had a violent pain in his stomach, followed by vomiting and diarrhea, which lasted for about 12 days. Two weeks after this attack, he awoke one morning with a burning sensation in the tongue, followed by a notable swelling of the organ, which extended rapidly to the throat, interfering with deglutination and even rendering speaking difficult; during the day his face became swollen; he had no fever, and, on the following day, all the symptoms had disappeared. Three days later, there appeared a swelling on the dorsum of the left foot which made it impossible to put on his shoe; and, in a few hours, there was a similar one in the gluteal region of the same side. Since that time he has not had any other attacks of edema of the throat, but he has had attacks of colic with serious diarrhea. At the first examination, the patient did not present any abnormal signs in the larynx or pharynx, and he only complained of a troublesome wind that came up from the stomach to the throat. There seemed to Dr. Martinez to be a spasm of the esophagus. This patient had been healthy all his life, suffering only from an occasional headache. He does not know of any member of his family having ever had this disease, and he cannot ascribe it to any error in diet. Examinations of the urine and blood were made by Dr. Plasencio. The urine was normal. The only changes noticeable in the blood were (1) an enormous eosinophilia, 33.3 per cent instead of the normal 2.3 per cent; (2) a diminution of the polymorphonuclears, 30.4 per cent instead of 74 per cent; (3) diminution of hemoglobin.

McS.

NEOSALVARSAN IN PARENCHYMATOUS KERATITIS.—(*Archivos de la Soc. de Estudios Clinicos*, Havana, March, 1914.) Dr. Jorge. L. Dehogues reports three cases of parenchymatous keratitis that were cured with neosalvarsan. Two of these cases were of hereditary and one of acquired syphilis. The disease is one of long duration and taxes the confidence of the patient and the resources of the physician to the utmost. Neosalvarsan not only produces prompt results, but it seems to jugulate the affection while protecting the healthy eye. Much has been written on the action of neosalvarsan, particularly in keratitis; and

it is particularly in this last field that opinion is divided. Dr. Dehogues' cases, therefore, are an important contribution to the subject. His first case was a little girl, age 4. In early infancy she had a specific hepatitis, which quickly yielded to mercurial treatment. When first seen for her eye troubles, she had parenchymatous keratitis in both eyes, in the first stage of infiltration. A specific diagnosis having been made, an intensive mercurial treatment was institutel; the disease was not jugulated, but ended in a cure. Dehouges thought of using salarsan—for that was before the days of neosalvarsan—but he was deterred from using it by the tender age of the patient. Things went on this way for a little more than a year, when he was again called upon to attend the child, this time for a choroiditis in the left eye. Dehogues resorted to the former treatment, but the patient did not respond. A recrudesence of the parenchymatous keratitis almost made the doctor despair. After consulting with the family physician, he screwed his courage up to the point of injecting 10 c. c. of neosalvarsan in a vein at the elbow. The remedy was surprisingly well tolerated. The effects were prompt and marked: in 48 hours the photophobia and blepharospasm, which had been intense and intolerable, disappeader and the pericorneal and ocular symptoms diminished visibly. Six days after, the infiltration commenced to disappear, and in 20 days the corneas had regained their transparency so that the fundus could be clearly examined and the choroid seen to be normal. The effect of the neosalvarsan was not confined to the eye, for the general nutrition improved greatly. In the second case, 24 years, the system was weakened with syphilis acquired a year before. The diagnosis was clear. There was atypical parenchymatous keratitis in the right eye; left eye, normal. There was also iritis, photophobia and blepharospasm intense. Fifteen c. c. of neosalvarsan were injected intravenously at the elbow. In a few days the symptoms began to improve, and in 30 days he was cured, the cornea being perfectly transparent. A second dose was given in 7 days. The value of the neosalvarsan is shown not only in its effect on the sick eye, but also by its prophylactic action on the sound eye, which remained intact, for it is the rule that the other eye becomes involved in

a few days in spite of treatment. The third case was a girl of 8 years, in whom a positive Wassermann reaction left no room for doubt as to the diagnosis. A few months before coming under Dr. Dehogues' care she had received the classical treatment, but without benefit. Intravenous injection of neosalvarsan produced the same results as in the previous cases. Three doses in all were given, at intervals of 7 days. McS.

EMETINE TREATMENT OF DYSENTERY IN YOUNG CHILDREN.—Archibald (*Jour. Trop. Med.*, 1914, XVII, 161) draws the following conclusions: (1) Young children are extremely tolerant of emetine. In severe cases of entamebic dysentery it is advisable to commence with an initial dose of 1/6 gr. for a child of 2 years, and to repeat this dose every 12 hours until a total of 1/2 gr. has been given.

(2) The total amount of emetine administered should be controlled by the evidence obtained by microscopical examination of the stools, a procedure which should also be carried out at intervals during convalescence.

(3) In order to avert relapses, continued treatment by emetine after the patient's apparent recovery from dysentery is advisable.

(4) In entamebic dysentery of the Sudan, it may be necessary to give emetine in larger doses than are usually employed in other countries.

John M. Swan.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editor as of special interest to the readers of this JOURNAL will be reviewed

CROSKEY, JOHN WELSH. Anatomy and Physiology of the Eye and Its Appendages. Pamphlet published by Smith-Edwards Co., Philadelphia, Pa.

FERRY, N. S. Infection and Immunity: A Review. Rep. from the Journal of the American Pharmaceutical Association, Vol. III, April, 1914.

HOFFMAN, FREDERICK L. The Chances of Death and the Ministry of Health. Address delivered before the Divinity School, Yale University, New Haven, Conn., March 30, 1914.

HOUGHTON, E. M., and DAVIS, LEWIS. A Study of the Germicidal Action of the Ultra-Violet Rays. Rep. from the American Journal of Public Health, Vol. IV, No. 3.

KEARNEY, HAROLD LESLIE. On the Relative Growth of the Organs and Parts of the Embryonic and Young Dogfish (*Mustelus canis*). Rep. from the Anatomical Record, Vol. 8, No. 5, May, 1914.

TROPICAL DISEASE BUREAU. Report to the Managing Committee on the Library of the Tropical Disease Bureau.

BOOK REVIEWS

CONQUEST OF THE TROPICS. By Frederick Upham Adams. Doubleday Page & Co., Garden City, New York, 1914.

The people of the United States have had no conception of the great work of the United Fruit Company in the Tropics. The enterprise which has put the "sterile food in the aseptic package," as the banana has been called, in almost every hamlet in the United States and Canada, has become known commercially. Few persons, however, know how far the influence of the United Fruit Company has served in making health zones around their stations and how far this company has brought modernity into the lives of the people. The book before us tells some of these things and in so fascinating a manner that it reads like a romance.

"It has not yet dawned on our political leaders that our Tropics are a great but unused asset," says the author; and further, "any enterprise or statesmanship which increases the productivity of these tropical sections adds chiefly to the assets and welfare of all the people of the United States."

The book is full of information and full of descriptions and illustrations which are presented for the purpose of showing the Eldorado south of us, and it merits the fullest appreciation of the reviewer, who

may only casually comment on some of the many wonders detailed. Every once in a while we meet a man who comes back into our crass civilization after a few years in the Tropics—and he always wants to return to the south. He utters the influence of the glamor of the country he has left and is inspired with the mysteries of some promise. Between the lines of many pages of this book we read and understand this motive which has dictated the desire to master new countries. More than anything else in the story told by Mr. Adams, though, is the graphic relation of the development of the sanitary side of the attack on the Tropics—and this is history.

The enterprise of the United Fruit Company pointed the way to preventive measures against disease, and to-day the entire coast line, with stations on the islands of the West Indies as well, carries a chain of modern hospitals—and with them both education and sanitation.

The work has gone on until every port of importance along the Gulf coast and Atlantic seaboard is punctuated with the entry of some of the "Great White Fleet" of the United Fruit Company, not only charged with supplying commodities in fruit, but affording the opportunity to many travelers to journey in comfort and in safety to these countries, which before the efforts of the company were indeed *terrae incognitae*.

Costa Rica, Guatemala, Cuba, Jamaica and Panama are all more than glimpsed and the narrative is full of appeal to those who wander for the pleasure of seeing new peoples and new climes.

We are thankful at having had the opportunity of reading this book and of having had the chance to get in full touch with the story of the "Conquest of the Tropics," told in a manner which leaves only a sense of pride in the vigor, integrity, righteousness and service to the American people as evidence of the enterprise of a business concern, with conscience enough to have brought health with wealth in that enlightenment among what was not so long ago a jungle.

Dyer.

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CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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AUGUST, 1914

No. 2.

EDITORIAL

Life Assurance and Preventive Medicine.—When we adverted during the past year to the possibilities of life insurance coöperation for the preservation of health, it was so largely speculative that we hardly expected any early activity on the part of life insurance companies.

It is gratifying now to note that the Equitable Life Assurance Society has actually begun along the lines discussed by us. In the "*Human Factor*," the official publication of the Society, for July, 1914, the announcement is made that after July 1, 1914, systematic examinations will be offered to all policy holders of three or more years standing. These examinations will be conducted by regularly salaried physicians of the company and they will be free. The examinations will include certain laboratory examinations, not yet fully defined.

The Society clearly presents its purpose of conserving the health of its policy holders and disclaims any intention of interfering with the physician usually employed by the policy holder. Moreover, the function of the Society is purely advisory and undertakes in no manner or fashion the treatment of the examinee.

The direct results of the operation of the plan proposed will be advantageous alike to the Society and to the policy holder, by conserving the health and prolonging the life of the individual and by producing economies in the administration of the Society, and at the same time adding to the revenues.

The aims of the life insurance corporation as set forth by the Equitable company are to (1) provide sure protection, (2) to give efficient and economical service, (3) to increase the Society's usefulness as a public institution, apply to all corporations engaged in life insurance. The last proposition strikes us as the one which concerns the public most. The readjustment and rehabilitation of life insurance in the United States in the past decade has forced the life insurance company into the position of a public institution. The scandals in their operation created the former opinion that life insurance concerns were conducted chiefly for the stockholders. Now all this has changed and with the better companies organized on a mutual basis the policy holder shares with the stockholder the benefits of the progress and industry of the company.

Many states compel the reciprocal investment of funds by the insurance company and so regulate the investments as to make them of service to the state; more than this, the vast funds of the insurance companies must be invested safely for the policy holders' protection. While this has no direct bearing on the health assurance side of the question, it all points to the public service of the corporation.

We are struggling to-day with a large variety of economic problems related to human life and new avenues open up all the time.

The sociologic phases are in a great tangle and need large education before they are even understood; the future may offer some way to the solution.

Among the questions of public health, the conservation of the individual will be as essential a factor as any and it will require much education to make the individual realize this for himself. The life insurance company has more machinery in operation for effective work than any other existing force and the initiative taken by the Equitable Society must make the opportunity for others to follow the example.

The development of child welfare and the education of the young make the task lighter as the years go by and as the coming generations have a growing concept of right living; but we can only applaud any beginning in the right direction and with our earnest wishes and efforts speed it on its way.

Isadore Dyer.

Borax and the Typhoid Fly.*—The U. S. Department of Agriculture announces that a small amount of borax sprinkled daily on manure will effectually prevent the breeding of typhoid or house flies. Further, that this same substance will prevent fly eggs from hatching in garbage, refuse, cellars, markets, privies, etc. Borax will not kill the adult fly nor prevent it from laying eggs, but its thorough use will prevent fly breeding.

The investigation was undertaken with a view to finding some substance which would prevent fly breeding in manure and yet not introduce in the manure any substance that would interfere with the fertilizer value of the manure.

From experiments at Arlington Farm, in Virginia, and at

*Bulletin No. 118, U. S. Dept. of Agriculture.

New Orleans, Louisiana, the investigators found that 0.62 of a pound of borax or 0.75 of a pound of calcined colemanite (crude calcium borate) would kill the maggots and prevent the development of practically all of the flies breeding in eight bushels of horse manure.

In the case of garbage cans, two ounces of borax or of the calcined colemanite, or at an expense of about 5 cents per pound, will effectually prevent flies breeding.

This information is of vast importance. No more valuable contribution to preventive medicine has emanated than this and its significance should be noted as broadly as possible.

Borax is cheap and with the knowledge of its effectiveness against fly breeding every householder, every farmer, stock raiser or intelligent citizen should begin the crusade. The very simplicity of the thing is enough to commend it. If used in proper quantities, there can be no danger to stock, as small quantities of borax do no harm. If garbage is treated with borax, if privies are supplied with borax as they used to be with lime, the day of the fly will soon be over.

This announcement of the Department of Agriculture must be far reaching and its results will add much to the glory of preventive medicine.

D.

Vaccin Lichen in Natives.—Chalmers (A. J.) and Byam (W.), in the *Jour. of Trop. Med. and Hyg.*, May 15, 1914, present an interesting study of an unusual sequel of vaccination, more interesting than usual, perhaps, on account of the occurrence in dark skinned individuals. Attention is called to the paucity of literature on vaccin rashes in the dark skinned races and no explanation is offered for the lack of observation.

Eleven cases in all were studied, among sixty using the same vaccin, and those selected for particular study showed a papulovesicular eruption which the authors are inclined to classify

as a "generalized vaccinia" of the type of lichen as defined by Hebra and to be differentiated from the group fixed as a papular eruption and first described by Wilson.

The wide variety of accidents occurring with and after vaccination makes it difficult to accept such an eruption as a vaccinia, especially when such types as herpetiform dermatitis of the papular form may follow vaccination as a relapsing condition, persisting for months after the operation of vaccination has taken place.

The close similarity of the lichenoid eruptions in the group of erythema multiforme to the case illustrated would also argue the by-effect of the vaccination rather than the vaccin virus direct.

Excusing this opinionative digression, we are pleased at the observations of the writers of the paper, and at the exhaustive way in which the cases were studied. The occurrence of the eruption in a number of subjects within seven to nine days after vaccination, with constitutional symptoms and with some uniformity in the appearance of the eruption, would strongly argue the conclusions of the authors. On the other hand, the wide difference from the accepted form of generalized vaccinia would leave the question open for further consideration. *D.*

ORIGINAL ARTICLES
THE RELATIONSHIP OF THE RENAL LESIONS OF
ASIATIC CHOLERA TO THE ORDINARY NEPHRI-
TIDES WITH ESPECIAL REFERENCE TO
ACIDOSIS.*

By

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Outline.

- I. Introduction: classification of the renal lesions of cholera among the nephritides.*
- II. Cardinal features of acidosis: i. e., alkali starvation.*
 1. Clinical picture:
 - A. Air hunger;
 - B. Bright color of the venous blood;
 - C. Coma, partial or complete.
 2. Chemical pathology:
 - A. Increase in tolerance of body to fixed bases;
 - B. Decrease in the titratable alkalinity of the blood;
 - C. Decrease in the carbon dioxid content of the blood.
- III. Evidence of acidosis in the uremia of cholera.*
 1. Occurrence of the clinical symptoms.
 2. Evidence of diminution in the carbon dioxid content of the blood.
 3. Increase in tolerance to bicarbonate.
 4. Absence of any evidence to indicate that the increase in tolerance to bicarbonate is due to renal retention.
 5. Beneficial effect of alkaline therapy.
- IV. Etiology of the acidosis of cholera and the unity of relative and absolute acidoses.*

It frequently happens that some of the problems of general medicine can be studied to the best advantage with material

*Read at the Eleventh Annual Meeting of the Society of Tropical Medicine, held at Boston, May 29, 30, 1914.

which occurs only in the Tropics. In the extensive amount of work which has been carried out in the past five years upon renal function, comparatively little attention has been given to acute nephritis. Indeed, the acute nephritides are of comparatively rare occurrence even in the larger clinics. In Asiatic cholera, however, in practically all cases that live till the stage of reaction, acute renal lesions develop, terminating frequently in uremia. The study and the treatment of uremia is of considerable importance, therefore, in the handling of cholera patients.

Some question has been raised as to the exact relationship between the renal lesions of Asiatic cholera and the ordinary forms of acute and chronic nephritis. It has been suggested that the lesions in cholera do not constitute a true nephritis and that the uremic stage is not comparable to true uremia. In considering the relationship of the renal lesions in cholera to the ordinary forms of nephritis and uremia, one must remember that the interpretation of the common nephritides is not altogether simple. There is some variation of opinion in regard to the relationship of the ordinary forms of nephritis to each other and there is no uniformly accepted standard for the diagnosis of uremia and its differentiation from the confusing cardiac and cerebral conditions. In regard to the classification of the nephritides, it has been maintained in recent years that chronic nephritis of the well-known interstitial type is not an inflammatory process, and should not be regarded as a nephritis.¹ The diagnosis of uremia is likewise a complicated problem. The state of uremia is evidently due, not to a single cause, but it is the combined result of a number of factors working together. Frequently, a definite classical picture predominates, and is easily recognized; any disturbance in the relative importance of the usual causative factors may give a distinctly atypical picture. Also the presence of cardiac or of cerebral lesions may cause confusion, either by obscuring the symptoms of uremia when present, or by simulating a rather typical picture of uremia, even though it is absent.

From these considerations it is apparent that there is considerable latitude in the scope of the conditions which may be

included under the general designation of nephritis. Certainly, the clinical picture of the renal symptoms in cholera is that of an acute nephritis. It seems to the author that the cholera kidney corresponds more closely than some of the chronic renal lesions do to the group of nephritides. Likewise, the uremia of Asiatic cholera corresponds in its essentials to the uremia of acute nephritis, both in its symptomatology and in its chemical pathology. Naturally, the precise relationship between the cholera kidney and the various nephritides cannot be determined until our information in both instances is more complete; it seems evident, however, that the renal complications of cholera have many fundamental features in common with nephritis and uremia. In view of the somewhat heterogeneous groups of conditions which are included in the nephritides it would certainly seem desirable to consider that the renal lesions of cholera constitute a nephritis, regardless of whether the exact histologic picture conforms precisely to all of the characteristics of an inflammation.

The more recent studies upon renal function have not been applied to Asiatic cholera, but it seems probable that the functional tests would show the same general results that are found in other acute and chronic nephritides. Indeed, the functional disturbances of the kidney leading to the development of acidosis appear to be remarkably similar in the very acute changes that occur in cholera and in the extremely chronic lesions leading to the development of a contracted kidney. In the present paper, I shall consider the evidence of the existence of acidosis in cholera and its bearing upon therapy.

In the first place, it is well to summarize in a word the important characteristics of acidosis and the evidence upon which its existence in nephritis is based. In its ultimate analysis, acidosis consists in a general impoverishment of the body, from any cause, in fixed bases, or in substances which readily give rise to fixed bases. The symptoms which are characteristic of acidosis are due to a deficit of the body in base-yielding substances, especially the carbonates, and not to the presence of free acids, or even to the neutral salts of acids. Such erroneous expressions as *acidemia* have crept into litera-

ture, although it has been clearly shown by Walter² that death takes place in experimental acidosis while the blood is still alkaline to indicators such as litmus; Benedict³ found that, in the spontaneous acidosis of diabetes, there was no significant increase in the content of the blood in hydrogen ions. Toxic symptoms arising from the action of the salts of acids have been suspected in some acidoses, but they are not firmly established. In any case such symptoms should be considered only as a special feature of certain acidoses, and not as a necessary factor in all forms of acidosis. The clinical symptoms which are characteristic of acidosis are: (1) a more or less complete coma; (2) a form of dyspnea known as air hunger, in which the respirations, though not often much increased in rate, are very deep and with a tendency to prolonged expiration; (3) the color of the venous blood and the mucous membranes is very bright. These changes can all be explained by the deficit of the body in carbonates. The chemical pathology is characterized by the following features: (1) an increase in the tolerance of the body to fixed bases; (2) a decrease in the titratable alkalinity of the blood; (3) a decrease in the carbon dioxide content of the blood (and the alveolar air.) The administration of bicarbonates restores these factors to normal and relieves the symptoms of acidosis, not by neutralizing acids, but by furnishing carbonates to function, as such, in the body. If bicarbonate is neutralized shortly after injection into the body, then the symptoms of acidosis, i. e., alkali starvation, will persist. The carbohydrate metabolism may or may not be disturbed in acidosis. The ammonia coefficient of the urine may be normal or it may be increased; however, conditions also occur in cholera in which the excretion of ammonium salts in the urine is markedly increased, although no acidosis is present.

This group of clinical symptoms and the increase in the tolerance of the body to bases with the accompanying changes in the alkalinity of the blood develop in chronic renal disease (chronic interstitial nephritis and primarily contracted kidney) and reach their height during the stage of uremia. In cholera, renal disturbances develop in practically all outspoken

cases; uremia is extremely common, and it is often responsible for death of patients after the danger from enteritis has passed. The exact incidence of death from uremia varies, of course, with each epidemic, but 15 per cent represents a fairly common average when patients are treated by the ordinary routine with liberal injections of normal salt solution. Thus, the death rate from uremia alone is higher than in the majority of the common specific bacterial infections. During the stage of reaction, when the evidence of nephritis is becoming prominent, a distinct increase in the tolerance to sodium bicarbonate develops.⁴ This occurs not in isolated instances, but in practically all cases. The explanation of this phenomenon is obviously open to two interpretations: either the bicarbonate is retained to replace a deficit of carbonates in the body, or the injured kidney is unable to excrete the injected bicarbonate and it accumulates in the body as an excess over the normal content. Furthermore, the cause of this increase in tolerance (whatever may be the explanation of the mechanism of it) may be due, primarily, to the cholera infection, or it may be relatively independent of the infection and represent the result of the renal lesions. Subsequent examination of the ordinary forms of nephritis showed that this tolerance was present in high grade, not only in nephritides resulting from other infections, but also in atherosclerotic cases in which no infection was present.⁵ Similar results have been reported by Palmer and Henderson.⁶ Subsequently, the examination of the titratable alkalinity of the blood in chronic nephritis showed a pronounced deficit in the carbonates; this deficit was in general proportional to the degree of the increase in tolerance for carbonates.⁷ Such a parallelism establishes that the increase in tolerance to bicarbonate in chronic nephritis represents a deficit of the body in fixed bases; i. e., an acidosis, and not an accumulation of bicarbonate in the body over the normal on account of suppression due to renal lesions.⁸ From these considerations it is clear that the nephritis of cholera is sufficient to account for the increase in tolerance to bicarbonate although the data required to establish this explanation are not altogether complete. In the ex-

amination of two cases of uremia, Dr. Shaklee and myself found a distinct lowering of the carbon dioxid content of the blood.⁹ No conclusive evidence is available in regard to the titratable alkalinity though the results obtained by titration methods suggest a definite lowering. The ammonia excretion in the urine, unlike the usual chronic nephritides, is increased both relatively and absolutely. However, this might represent equally well either a primary disturbance of protein metabolism or a secondary process to compensate for an acidosis, since disturbance of the urea forming functions of the body may result in an accumulation of ammonium salts instead of their conversion to urea. It is not unreasonable to suppose that the toxic condition of cholera patients and the profound disturbance in the circulation of the blood may be accompanied by extensive metabolic changes. At all events, it is certain that the increase in the output of ammonia does not afford any definite evidence as to whether the increase in tolerance to bicarbonates in the stage of nephritis in cholera is due to acidosis. There are several factors, however, which leave practically no doubt but that this increase in tolerance is due to an acidosis; i. e., that the essential factor in its explanation is a deficiency of the body in carbonates. The following factors are especially important:

1. The clinical symptoms;
2. The examination of the blood for carbon dioxid and titratable alkalinity;
3. The behavior of the kidney in other conditions with respect to injections of bicarbonate;
4. The effect of alkaline therapy on the development and course of uremia.

The clinical picture of acidosis in the uremia of cholera is almost as characteristic as in diabetic coma. The air hunger is typical, occurring ordinarily without any physical changes in the chest to account for it. The color of the mucous membranes and the venous blood is often very bright. The mental distress develops early, the coma becoming very deep. Thus, the symptoms of Kussmal's coma are often much more characteristic than in the uremia of chronic renal disease,

since the condition develops acutely and is usually free from the complicating changes in the blood vessels, heart, and lungs, that so commonly accompany a chronic diffuse nephritis.

The determination of the carbon dioxide content of the blood in two typical cases gave values of 16% and 26% as compared with a normal of 40 to 50%,⁹ a lowering corresponding to that occurring in ordinary uremia.⁸ This result, although only two cases were examined, is sufficiently sharp to be suggestive of an acidosis.

Absence of Evidence Indicating Suppression of Bicarbonate by Diseased Kidney.

The effect of various types of renal lesions with respect to the excretion of bicarbonate is instructive. In the examination of a wide variety of kidney lesions occurring in conditions other than cholera no evidence has been obtained of any appreciable degree of renal suppression of sodium bicarbonate; on the contrary it has happened in certain instances that kidneys with extensive diffuse lesions have excreted bicarbonate very freely.⁵ Thus it is seen that there is no analogy for any supposition that there may be an accumulation of bicarbonate in the body in excess of the normal on account of renal suppression. If such a condition were proven to exist in cholera it would constitute a rather striking exception to the other types of renal lesions that have been investigated.

Finally the effect of alkaline therapy is important in connection with the evidence indicating acidosis. In the cholera wards of San Lazaro Hospital at Manila it was found that the early administration of sodium bicarbonate in relatively large amounts practically eliminated death from uremia. This treatment was tested during two epidemics. The patients were divided into two groups; half of them received some form of sodium chlorid solution, either isotonic or hypertonic, while the other half received some form of alkaline therapy. In the first epidemic, two salts were used as sources of alkali; namely, sodium acetate and sodium bicarbonate. In the case of the bicarbonate, some of the stronger solutions occasionally contained considerable

carbonate, so that the effect of this third salt was also observed. The concentration and dosage were varied considerably, as well as the stage of the disease at which treatment was commenced. The following outline gives a general summary of the results during the first epidemic:

Treatment—	No. of Cases.	Deaths in Uremia.	Total No. of Deaths.	Total No. of Recoveries.
Chlorid	56	8	40	16
Bicarbonate and acetate.....	55	1*	28	27

In a somewhat milder epidemic a similar result was obtained. A Locke-Ringer's solution was used in place of normal salt solution; for the series with alkaline treatment, a solution of $\frac{1}{2}\%$ sodium bicarbonate in 0.6% sodium chlorid was given in the stage of collapse, using whatever volume of fluid was indicated. During the stage of reaction this concentration of bicarbonate was increased to 2% and its administration continued until an alkaline urine was obtained or until the patient was voiding freely. The results in this epidemic were as follows:

Treatment—	No. of Cases.	Deaths in Uremia.	Total No. of Deaths.	Total No. of Recoveries.
Ringer's sol.....	22	4*	9	13
Bicarbonate†	22	0	4	18

The following outline gives the combined results of the two epidemics:

Treatment—	No. of Cases.	Deaths in Uremia.	Total No. of Deaths.	Total No. of Recoveries.
Neutral Solution	78	12	49	29
Alkaline Solution.....	77	1	32	45

This number of cases is too small to permit of any definite conclusions from percentages alone. It is significant, however, that the increased number of recoveries under alkaline therapy corresponds rather closely to the number of deaths in uremia in the cases treated with the various modifications of normal salt solutions. The behavior of the individual cases under alkaline therapy was very different from those receiving neutral

*This was an apparently mild case and the injections were discontinued very early.

*Two of these cases showed some symptoms of collapse.

†Some of these cases also received large doses of an anti-cholera serum.

salt solution. In the cases admitted late in uremia, the injection of large amounts of bicarbonate relieved the dyspnea promptly; the restlessness of the patients was relieved much more promptly by alkaline therapy than by morphia. A free secretion of urine always occurred even within a comparatively few hours after the administration of bicarbonate; in some advanced cases a fatal result occurred when the administration was delayed till a late stage of uremia had developed, even though a polyuria was produced by the injection. In general it would seem that the administration of alkalies is indicated as early and in as large amounts as they can be given without interfering with the treatment of collapse. In this second epidemic the patients responded very well to a solution containing one-half of one per cent of sodium bicarbonate. This may be given in whatever volume is ordinarily necessary for the restoration of fluid to the body, usually an injection (intravenously) of 2 liters to be repeated at six or eight hour intervals, if indicated. In the series where stronger solutions were used occasional cases occurred which did not respond quite as well in the stage of collapse as one would expect. Moreover, a one-half of one per cent solution of bicarbonate furnishes sufficient alkali so that there is ordinarily no technical difficulty in introducing whatever amount of bicarbonate is desired during the stage of reaction. In this stage a solution of two percent in water may readily be used (intravenously) until the urine becomes alkaline, or until free secretion, even a polyuria, develops. The exact concentrations to be employed are open, of course, to modification according to individual circumstances; for example, further experience may show the advisability of introducing other salts than sodium chlorid and bicarbonate in the solution to be injected. If vitalistic, as well as physical phenomena are concerned in the loss of fluid from the blood vessels, then it might be advisable to introduce diluted blood serum for intravenous injection. It seems not impossible that some of the favorable results following the use of large injections of serum may have been due to its slower escape from the blood vessels as compared with aqueous salt solutions.

In any case, when bicarbonate is employed it should be care-

fully protected from conversion to normal carbonate. The solution should preferably be sterilized in tightly stoppered bottles in an atmosphere of carbon dioxide and kept stoppered till ready for use.⁵ If this is impracticable, fresh stocks of chemically pure bicarbonate in small containers can often be obtained on the market, which are sterile. These can be dissolved in sterile salt solution, or in water, just before using, according to the concentration of bicarbonate which is desired. Immediately upon solution, slight conversion to the normal carbonate takes place and this increases markedly on standing, especially if the solution is exposed to the air.

Various measures have been suggested for meeting the uremia of cholera. Rogers¹⁰ has studied the effect of hypertonic solutions of sodium chlorid, recommended for the stage of collapse, upon the development of uremia. In his hands, the mortality from uremia has been materially reduced. This treatment is directed primarily toward measures for the restoration of fluid to the body. It would also seem equally necessary to replace the carbonates that are lost. The carbonates are as necessary to life as fluid, though they are not depleted quite so early or so markedly as the fluids during an attack of cholera. Minimal amounts of carbonates have been recommended by the various text-books on tropical medicine, but the maximum quantities advised are insignificant in comparison with the physiological requirements of the body.¹¹ Furthermore, they are administered without reference to the purpose for which they are required and without any guide as to the quantity which is necessary in the individual cases. Wherry¹² has suggested an intensive alkaline therapy, consisting of the use of ten grams of sodium chlorid and twenty grams normal sodium carbonate in a liter of water. No guide, other than the general clinical condition of the patient, is suggested for determining the quantity of such a solution which is to be used. A limited use of solutions of bicarbonate in which considerable conversion to normal carbonate had taken place, has led me to believe that the use of the latter, especially in the presence of symptoms of collapse, is distinctly dangerous.

A very ingenious theory has been proposed by Emmerich.¹³

He conceives the toxemia of cholera as arising from nitrites produced by the action of the cholera vibrio. This theory has not received substantial support. If considerable quantities of nitrous acid were produced, it might bear an etiologic relation to the development of acidosis. However, there is no evidence in the theory of Emmerich which bears directly on the question of acidosis.

Consideration of the Etiology of Acidosis in Cholera.

There are at least two factors which might contribute readily to the production of an acidosis in cholera; namely, the disturbance of renal function and the loss of alkali from the bowel. Complete or partial suppression of urine would lead to the suppression of a certain amount of acid. A rather unexpected phenomenon was observed in regard to the urinary acidity. Upon the administration of moderate amounts of bicarbonates, it was found that the already highly acid urine increased still more in acidity. This might be interpreted as indicating that the functional capacity of the kidney in the elimination of acid improved under alkaline therapy.

As regards the loss of alkali from the bowel it is quite possible that considerable amounts of fixed bases may be lost during the excessive purging that occurs. However, there are apparently no definite data in regard to the amount of fixed bases which may be lost under these conditions. These two processes, namely, the suppression of acid salts by the kidney and the loss of fixed bases by the bowel, afford typical examples of two distinct methods by which a depletion of the body in carbonates may be produced. If one divides the acidoses into two types, namely, an absolute form in which the bases are neutralized by acids and a relative form in which the bases are lost from the body as such, then cholera would furnish an excellent example of a condition in which both types of acidosis occurred simultaneously. However, the end result in either case is an impoverishment of the body in fixed bases and the condition as regards acidosis is fundamentally the same regardless of the method by which it is produced. The conditions which are found in cholera suggest definitely that the division of acidosis into two types according

to the mechanism of its production is misleading and that these two types depend upon the same principle.

It is evident that some of the symptoms of uremia which resemble toxemia are due, not to the presence of a foreign toxin, but to the depletion of a normal constituent of the blood. In principle, this condition bears an analogy to beri-beri, in which the symptoms simulating toxemia arise from a deficiency of necessary substances in the diet.

Summary.

1. Investigation of the ordinary forms of chronic and acute renal disease have shown that the increase in tolerance to bicarbonate which was found to occur in the uremia of Asiatic cholera is not specific for the nephritis of cholera. It occurs not only in nephritis arising from other infections, but also in nephritides which are free from infection.

2. The cause of this increase in tolerance in cholera is almost certainly due to an acidosis; i. e., to an impoverishment of the sources of fixed bases in the body. It is conceivable that this deficiency in carbonates is perhaps due to two factors, namely, (1) a diminished excretion of acid on account of the urinary changes; (2) and a loss of alkali directly by the bowel. The conditions in Asiatic cholera afford evidence of the inadvisability of distinguishing between relative and absolute acidosis.

3. The cause of the increased excretion of ammonia in cholera is not known. Two factors must be considered in its explanation, namely, (a) the possibility of a primary disturbance of protein metabolism with defective synthesis of urea, and (b) a secondary disturbance of metabolism with an accumulation of ammonia to compensate for an acidosis.

4. The evidences of acidosis in the uremia of cholera are sufficiently definite to constitute a rational basis for treatment of this condition with alkalis.

5. The examination of the urine or the blood affords a rational guide of the amount of bicarbonate to be administered.

The available evidence indicates that it is advisable to give a mildly alkaline solution (one-half of one per cent of sodium bicarbonate) early in the course of the disease, before an out-

spoken uremia has developed, increasing the quantity if symptoms of uremia appear. As much as 100 grams of bicarbonate may be required in the course of two or three days. The quantities which have been recommended in the text-books are wholly inadequate to restore the body to its normal content in carbonates. Moreover, the dosage is determined without any guide other than the general condition of the patient. The modifications of alkaline therapy for cholera, suggested by Wherry, is unnecessarily intensive. A limited use of the normal carbonate in cholera has led me to believe that it is distinctly dangerous, especially in the early stage of the disease, when the administration of alkaline therapy promises most.

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Discussion.

DR. RICHARD P. STRONG, Boston, Mass.: All observers admit the benefit to be derived from the administration of alkalis in cholera. The treatment by hypertonic salt solution introduced by Dr. Leonard Rogers is an instance well known.

DR. J. LEFFINGWELL HATCH, New York City: In the cases studied by Dr. Sellards had any functional tests of the kidneys been made?

DR. C. C. BASS, New Orleans, La.: Is the acidosis due to exosmosis or to the failure of the tissues to abstract the fluids from the gastrointestinal tract?

DR. JOHN M. SWAN, Rochester, N. Y.: In *Heart*, Volume V, page 45, 1913, there is an elaborate paper by Thomas Lewis and his associates on dyspnea in cardiac and renal patients. The authors point out that in many cases of cardio-renal disease the dyspnea is due to acidosis and they are rather inclined to put the blame upon lactic acid. Has Dr. Sellards made any estimation of acetone in the urine in the cases that he has studied? About a month ago I had an opportunity of listening to Dr. Martin Fisher explain his theories concerning acidosis in nephritis and I must say that I have never heard a more convincing argument.

DR. GEORGE C. SHATTUCK, Boston, Mass.: We have done some work in Boston on nephritics with reference to acidosis along the lines described by Fisher. Our work seems to show that many of Fisher's claims are unfounded and the treatment with alkalis has not been successful. We studied our cases from the point

of view of hydrogenion concentration. There is, of course, considerable difference of opinion as to what constitutes acidosis.

DR. ANDREW W. SELLARDS, Baltimore, Md.: My studies on nephritis occurring in cholera were made before the present functional tests of renal efficiency were introduced. I believe the loss of alkali to a certain extent is due to the failure of absorption from the intestines and that it is not a starvation acidosis. In twenty cases the acetone in the urine was about normal and once only was it over normal. Lewis and his associates were not able to confirm their suspicion concerning the influence of lactic acid. They could not find it increased in the blood. In regard to Martin Fisher's work, I believe acidosis is a secondary effect of the disease and not the cause of the disease. Martin Fisher believes that there is an increased accumulation of acid in the tissues, especially in the kidneys. This has not been proved. Before therapy by alkalies is undertaken the fact that acidosis exists must be determined. In many cases of nephritis treatment by alkali does harm.

HOW WAR HAS BEEN WAGED IN MEXICO AGAINST THE MOSQUITO.*

By

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Mexico City.

Although in former meetings I have made reference to the manner in which war has been waged against the yellow fever in the Mexican Republic, it is my purpose to-day to state what has been done in the premises, the scientific bases upon which the campaign were determined, the results obtained and the present situation.

After Drs. Reed, Carroll and Agramonte of the Army of the United States of America, by means of the experiments which will ever remain consigned in the scientific world as a monument to them, proved that yellow fever is transmitted through the mosquito *genus stegomyia*, and after I had been persuaded personally of the measures taken by Col. Gorgas at Havana to combat the yellow fever, I returned to Mexico to establish the plan based on the principle already accepted by the sanitary science and which may be formulated as follows:

In order that yellow fever may appear, it is necessary the union of these three factors:

1. A yellow fever patient.
2. A *stegomyia* mosquito that bites the yellow fever patient and that after 12 days is able to convey the disease; and
3. A non-immune individual against yellow fever, who is bitten by such an infected mosquito.

If the union of these three factors is necessary for the propagation of yellow fever, it will be sufficient to *separate them*, so that the disease cannot be produced.

From this conception may be deduced these three leading rules:

*Read by title at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held at Boston, May 29 and 30, 1914.

- 1st. To isolate the yellow fever patient so that he cannot be bitten by the mosquito.
- 2nd. To exterminate the mosquito.
- 3rd. To protect the non-immune individual against the mosquito bite.

I. Isolation of the Yellow Fever Patient.

The isolation of a yellow fever patient, as also of him who may be suspected of being infected, is done by putting him in a room, the windows of which are furnished with such a closed wire screen that a mosquito cannot go through it, and with a double door also wire screened, and placed in such a manner that the two may be separated by a distance of one meter, and connected by a thick cord, so that the outside door cannot be opened till the inside one is closed. A room so arranged is then fumigated with sulphur in order to exterminate the infected mosquitoes that might possibly be in the room. Under these conditions the patient remains wholly isolated from mosquitoes on the outside that otherwise might have bitten him.

II. Extermination of Mosquitoes.

This can be accomplished by the destruction of the mosquito-breeding places, and it is obtained by drainage of the marshes, either by canals which allow the stagnant water to flow, or by filling the marshes. When neither one of these two can be done, the marshes' surfaces can be covered with a thin coat of petroleum which can be renewed every time it is needed. The lesser extensive water deposits, such as served to preserve drinking water or for domestic purposes, are covered up with a lid, which can be sprinkled with thinner coats of petroleum, and finally, the water deposits can be dispensed with, however small they may be, and even though they be those of water put in a decorated flower-pot, or that of the hollow made by an animal's footprint or of any other deposit of the smallest size. In this way the breeding places are eliminated.

The larvæ already formed can be destroyed by putting a petroleum coat which at the same time that it prevents them from issuing forth to breathe the atmospheric air, thus poison

them. The salted mosquitoes are exterminated by fumigating sulphur in the closed rooms, and by setting on fire the plants where they may have taken refuge.

III. Protection of Non-Immune Individuals.

This is more difficult; however, it can be done by putting wire screens in the doors and windows of the houses occupied by them and protecting the corridors, be they ever so large, also with wire screens.

When they cannot have such a protection, they can at least protect themselves while asleep with a mosquito net; and when they have to go outdoors, they can put a veil over their hats, and they can wear gloves on their hands.

These are the means which should be employed; let us see now how we have put them into practice in the Republic of Mexico. In our shores on the Atlantic and Pacific oceans the *stegomya* mosquito exists, and yellow fever has reigned in the latter but in the epidemic form, whilst in the former, it has existed for four centuries in the endemic form, with epidemic exarcebations, but above all in the foci of Vera Cruz, Campeche, Merida and Tampico, and along the Tehauntepec Isthmus, from the Port of Coatzacoalcos on the Gulf to that of Salina Cruz on the Pacific. Hence, permanent sanitary brigades were established at Tampico, Vera Cruz, Coatzacoalcos, Progreso and at Merida on the Gulf, and at Salina Cruz on the Pacific, and shifting or flying brigades at Cordoba which look out for the State of Vera Cruz as far as Santa Lucrecia; at Coatzacoalcos with duty on the Isthmian region as far as Santa Lucrecia, and another at Salina Cruz which takes care of the Isthmus from the latter port to Santa Lucrecia.

The personnel of these brigades is formed of a chief doctor, and of auxiliary doctors in divers numbers according to the work to be fulfilled, and of some sanitary agents and servants employed to spread on the petroleum. Each town has been divided into a certain number of districts; a doctor is put in charge of it, having at his orders a certain number of agents and servants. In its locality there is made a list of non-immune individuals, that is to say, of those who have not been affected heretofore of

yellow fever, and there is filed for record the name, age and address of such individuals. With these data, a visit is made daily to all of the non-immune individuals, and if any one of them is found to have a temperature higher than $37\frac{1}{2}^{\circ}$, centigrade thermometer, a notice of it is sent to the doctor of that district, who orders immediately the isolation of the patient suspected, in a room which, as is stated above, has its doors and windows with wire screens, and such a patient undergoes a thorough observation. If the yellow fever is not confirmed, the patient is allowed to be attended in his own house, but if the contrary be the case, then he is kept in isolation. In the meanwhile, the sanitary agent disinfects the room occupied by such a person, as well as of the objects found therein; and if there be any suspicion that in the other houses of that neighborhood there might be some contaminated mosquitoes, they are also disinfected.¹

The sanitary agents make likewise a daily inspection of all the water deposits in order to ascertain if they contain larvæ, and if they are found, the water is poured on the floor and is covered at once with petroleum so as to exterminate them; the receptacle is scrubbed so that not one may remain alive; it is then filled with fresh water and it is covered with a lid. Under the agents' vigilance the servants place the petroleum in the large or small water deposits which cannot be covered, and renew it as often as it is necessary.

1. There are in our country some most humble huts called "Jacalos," wherein the poor class live, especially on the coasts. As they are made of the branches of trees, or of wooden logs, poorly joined together, and have the roofs formed of a dry plant called "zacate," it is not possible to fumigate them in order to destroy the mosquitoes, because they, as well as the sulphuric acid gas used to exterminate them, would escape through all the cracks of said huts, and hence, there would remain no other remedy but to burn them; but no property can be destroyed, however small it may be, without due indemnity to the owner of it, and the cost that this would entail is greater than that which the government has to spend on its campaign against the yellow fever.

However, the necessity to extinguish the latter was pressing, and this without destroying the huts. Dr. Narciso del Rio, Chief of the Sanitary Brigades against that disease, invented a cover to completely surround them, and so put them in condition to be fumigated without the mosquitoes getting away, nor the gas used to exterminate them. The description of the cover will be found in the annex to this paper; however, I wish here to put on record the author's name of this invention, which has been modified later on by the Cuban sanitary authorities; but in Mexico, that invented by Dr. del Rio continues to be used.—E. Licéaga.

The personnel forming its brigade varies with each locality, but that stationed in Merida, where the epidemic is rooted in for a long period, the brigade has numbered up to 114 persons. The service of the permanent brigades is carried on in the towns where they have been established, and that of the flying brigades is made throughout their corresponding circuit.

There is in the Republic of Mexico a service like which I believe there is not another in any part of the world, namely, that of the *Passengers' Agents*. These agents are employed in traveling daily in the passenger trains in order to take note of the list of the non-immune individuals, the names of passengers, from what place they come and to which they are going; and if he finds a passenger who has a temperature exceeding $37\frac{1}{2}^{\circ}$ centigrade, he hands him a hat that is provided with a large veil and that has in its free part a series of small lead pieces, and which that individual is obliged to put on. If the latter is lying down, an ordinary mosquito net is thrown over him, and the sanitary agent takes him to the nearest lazaretto to be found on the road. Of these agents, one travels from Cordoba to Vera Cruz, another from the latter to the former town, a third from Santa Lucrecia to Cordoba, a fourth from Vera Cruz to Tierra Blanca, and a fifth from the latter to the former place. On the Tehauntepec Isthmus an agent goes daily from Coatzacoalcos to Salina Cruz, while another makes the return trip at the same time. There are also passengers' agents between Merida and the Port of Progreso in Yucatan.

The campaign having been thus organized, the work for the year of 1903 was started and has been continued ever since without any interruption at any season of the year. Of course, if any epidemic focus breaks out, as occurred at San Juan Bautista, Tabasco, Frontera and on the Isla del Carmen, sanitary stations are established therein, or the number of these are increased where they existed already, as took place at Campeche last year. The result of this campaign sustained without any interruptions during eleven years has been not only to do away with the serious epidemics of yellow fever felt in former years, but to extinguish the endemic secular foci such as those hitherto at Vera Cruz and Merida. Thanks to this campaign against the

yellow fever, the last case of this disease registered at Tampico, took place on November 3, 1903; at Salina Cruz, Coatzacoalcos and in all the Tehauntepec Isthmus, there has not been an autonomous case during the last nine years; at Progreso since August 8, 1906; at Vera Cruz the last autonomous case was registered on February 11, 1909; at Merida, on November 20, 1912, and at Campeche, in the same month of November, 1913; and so, since this last date, there has not been any other case of yellow fever throughout Mexico.

It has seemed fit to me to make known to this Society the manner in which war has been waged against the yellow fever in the Republic of Mexico.

City of Mexico, May 22, 1914.

**NOTE ON THE SUPERIORITY OF INTRAMUSCULAR IN-
JECTION OVER ADMINISTRATION BY THE MOUTH
IN THE TREATMENT OF MALARIAL INFEC-
TIONS BY QUININ AND THE AVAILABIL-
ITY OF QUININ AND UREA HYDRO-
CHLORID FOR THIS PURPOSE.
TECHNIC OF THE INJECTION.***

By

SOLOMON SOLIS COHEN, M. D.,

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Malarial infection having occurred, prompt destruction of the parasite is not only curative, with regard to the individual, but also prophylactic as regards the community. Hence, consideration of the best means for this purpose may not be inappropriate here.

By universal consent, quinin is the best agent at our command, save in a very few exceptional cases. It is possible, also, that in these supposedly exceptional cases, quinin has not been used in the most effective manner.

The object of this note is to recall attention to observations long ago published, and recently reiterated,¹ concerning (1) the superiority of the double salt known as quinin and urea hydrochlorid (quinin-carbamid dichlorid) over the other salts of the cinchona alkaloid; and (2) the greater efficacy of intramuscular injection over any other form of administration, except possibly the endovenous route—for which latter method this salt is not recommended.

Whether the greater and prompter activity of the quinin-carbamid compound is owing to its ready solubility alone, or also, in part, to some physico-chemical property which increases its penetrating power or the velocity of its reaction, I do not know; nor am I aware of any studies elucidating the question.

*Read before the International Drainage Congress, Section on Malaria.

Certain it is that the clinical observations are beyond question or cavil. George E. deSchweinitz,² moreover, in his experiments upon toxic amblyopia, found this salt to possess, grain for grain, a greater toxicity than any other preparation of quinin employed in that research.

So long ago as 1884³ I observed and published the fact that in the ordinary cases of tertian or quotidian malarial fever, as observed in Philadelphia, a single injection of 15 grains (1 gram) of the double hydrochlorid of quinin and urea would cause a suspension of the paroxysms for either (a) approximately $6\frac{1}{2}$ or (b) approximately $13\frac{1}{2}$ days. These periods are suggestive, respectively, of (a) the anciently observed and well-known tendency to *weekly recrudescence* of the ague-fit in supposedly convalescent patients; and (b) of the variety of malarial fever with *fortnightly paroxysms* described by eighteenth century observers, and an instance of which, originating in India, was reported so late as 1892 by Commandante Gregorio Fedeli⁴ to the College of Physicians of Philadelphia. Nor can we ignore the close approximation of these freedom-periods to the significant cycles in the life history of the plasmodium.

The communication presented by me to the Fifth Annual Meeting of the American Society of Tropical Medicine summarizes 25 years' observations and gives a number of illustrative charts and blood-studies. They show approximately the same effect of the drug in tertian, double tertian, estivo-autumnal and quartan infections, as observed in more than 250 patients at the Philadelphia General Hospital and at the Hospital of the Jefferson Medical College. These included, among others, persons who had contracted the infection at Panama,⁵ in various of the West India Islands, in the U. S. Military Camp at Tampa, Florida, and, in two instances, apparently in Italy.

In more than 200 cases, there occurred, following a single injection of 1 gram of the quinin and urea salt, especially if this were administered during the paroxysm or within four hours thereafter, a prolonged, definite period of freedom. In 4 cases, two injections were necessary to bring this about. In about one-third of the cases, the freedom-period lasted between six and seven days; varying from one hundred and forty-one hours to

one hundred and sixty-two hours. In the remaining two-thirds of the cases, the period of freedom was between twelve and fourteen days, varying from two hundred and ninety hours to three hundred and twenty-six hours.

A fair statement of the average freedom-periods would be six and one-half and thirteen days respectively; or perhaps it might be termed seven and fourteen (week and fortnight) *organism days* of about twenty-two hours each.* The most frequent figures to be found in the notes concerning the week-cycle are one hundred and forty-seven, one hundred and fifty, and one hundred and fifty-six hours; in the notes concerning the fortnight cycle, three hundred, three hundred and six, and three hundred and twelve hours. But these figures are not exact, since they necessarily depended upon nurses' observations of the beginning of the chills, and they are given only as approximations.

As a rule, but not invariably, the cases showing the shorter period of freedom were quotidian (i. e., double tertian) in clinical type. Of those exhibiting the larger period, the preponderating number were simple tertian. The quartan case showed a freedom period of twelve and three-eighths days, with certain peculiarities, detailed in the report referred to.

When the injection is made within less than two hours before the calculated time of an expected paroxysm, it usually does not prevent the occurrence of the chill, although the phenomena are, in general, milder than usual. The paroxysm due to follow will, however, be missed, and the freedom period thereafter be manifested. When the injection is given three or four hours before the time at which a paroxysm is expected, it usually prevents the attack. When given between four and eight hours in advance of the calculated chill time, the injection will usually prevent both the paroxysm about to be due and its expected successor, but sometimes only the latter. The effect in this respect cannot be predicted with certainty. The freedom-period, however, ensues.

*Certain cases studied as to the time of recurrence of paroxysms indicated a period of 45 hours for the tertian cycle, instead of the 48 usually stated.

Administered by the mouth the carbamid salt likewise acts more promptly and more efficaciously (in equivalent dosage) than the other quinin preparations; but the difference is not so marked as when injection is made. The control of paroxysms is not so prompt, nor has there been so long an interval of freedom after a single dose, even when the quantity ingested has been so high as 30 grains (2 gm.). Taking these effects, i. e., the promptness of control of paroxysms and the length of the freedom-period after a single dose, as a test of relative efficacy, there is not the slightest doubt as to the immeasurable superiority of injection over administration by mouth, whatever be the preparation employed. And there could not be more definite or more appropriate criteria for comparison.

Quinin chlorhydrosulphate may be given in the same dose as the carbamid, by intramuscular injection (or by the mouth) and will often produce almost as marked and lasting effect; but it is not equally certain. There is a somewhat greater proportion of early recurrences.

The therapeutic (and hence prophylactic) significance of the prolonged freedom-period following a single injection of the carbamid salt of quinin is, of course, the evidence it affords of extensive destruction of parasites. If the theory be true that the blood serum is the actual agent of destruction and that quinin merely aids this natural defense by inducing a premature rupture of the infected erythrocytes, the superiority of the preparation in question might be explicable by the added hemolytic action of the urea. But despite the undeniable degree of confirmation given to the theory quoted by some of Bass's observations in the course of his culture experiments,⁶ I am not yet convinced that the serum is all-sufficient in cases of malarial infection in man, or that it can bring about prompt cessation of paroxysms when unaided by the distinctly plasmodicidal action of quinin.

Be this as it may, in again reporting the clinical studies here summarized, I must not be misinterpreted as advocating treatment of malarial fevers by a single injection of any quinin salt. The studies referred to were undertaken for information, and repeated annually for demonstration. For cure, the demon-

strative injection has always been supplemented by a further course of quinin; and when demonstration is unnecessary, the following general routine has been, and should be, employed—subject, of course, to such modification as individual reaction, intensity of infection, tendency to recurrence or chronicity, and the like, may indicate.

Either injections are given daily for a week, then weekly for a month, and then fortnightly for another month, or, after three injections, two doses of the quinin and urea compound, of 10 or 15 grains (0.6 to 1 gm.) each, are given daily, by mouth, in capsule—one in the morning, about 15 to 30 minutes before breakfast; and the other, 4 to 6 hours later, and likewise when the stomach is empty. As with the injections, the stomachal administration is kept up daily for a week, repeated weekly for a month, and then continued fortnightly for another month.

After that the patient is advised to take quinin in some form, by the mouth, in doses of from 15 to 30 grains, at least once a month for three months more; to have his blood examined monthly; and at the first suspicion of recurrence in any form, to seek medical advice.

I have had too little experience with pernicious malaria to dogmatise, but I am inclined to believe that treatment with the quinin and urea compound by intramuscular injection, in sufficiently large doses, repeated as often as necessary, would be beneficial.

The successful intramuscular administration of the quinin-carbamid salt demands that certain precautions be observed to avert cellulitis, abscess, or slough at the site of injection. In the absence of these precautions there may indeed be no ill result, but it is not wise to take chances, except, perhaps, in the presence of overwhelming emergency negating the slight consumption of time necessary—and I have not yet been confronted with such an emergency. The following ritual, gradually evolved, has been followed for 20 years or more, and seems to safeguard every point of danger.

1. The solution is to be prepared extemporaneously, all utensils being thoroughly sterilized in advance, and kept sterile. The quantity of the salt to be employed (ordinarily 15 grains

or 1 gm.) is dissolved in a syringeful of boiling water. The strength of the solution will thus be from 20 to 60 per cent, according to the size of the dose and the capacity of the available syringe. An optimum strength is 33.3 per cent, but I have used 40, 50, and even 75 per cent solutions without accident.

2. The skin is to be cleansed (preferably with tincture of green soap), and an area of about one inch in diameter is to be painted with tincture of iodine or iodine-acetone (10 to 20 per cent).

3. A high-pressure syringe, all glass, is preferable. The injection should be made deeply and the needle thoroughly emptied, so that upon its withdrawal retained solution shall not drip upon the punctured skin. As an additional precaution, the iodized skin may be covered with a piece of thin rubber-tissue, stretched taut, through which the puncture is then to be made. This, however, is not commonly necessary.

4. The point of puncture should be sealed with collodion, or, better, with iodoform-collodion.

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NEWS AND COMMENT

Of 1,188 children examined in Decatur, Georgia, all but eight were found to have hookworm.

Dr. W. H. Rennie, Surgeon, U. S. N., 6156 Sheridan Road, Chicago, Ill., has left that city and is now stationed at the Naval Recruiting Station, Boston, Mass.

The annual death rate from cancer in the United States is estimated at seventy-five thousand, and 90 per cent. of all cases, owing to ignorance or neglect, prove fatal.

The *Seemannskrankenhaus und Institut für Schiffs-und Tropenkrankheiten*, at Hamburg, has changed its name and will hereafter be known officially as the *Institut für Schiffs-und Tropenkrankheiten*.

Dr. Henri de Rothschild, of Paris, was shot but only slightly injured by a man who says that the opening of one of Dr. de Rothschild's philanthropic milk stations in his neighborhood ruined his business.

Dr. Roburg, of the Washington State Board of Health, has gone to Manila to continue his studies in tropical medicine. He will be a member of the staff of the Department of Pathology, University of the Philippines.

Four hundred and fifty thousand dollars have been appropriated by Fresno, Cal., to buy land and build new schools. Each school will occupy a block and they will all be of the open-air type, one entire side being of windows.

A farm has been leased in Essex, England, to be used for the segregation of lepers. The farm house will be used temporarily, but plans are being drawn for a permanent building. Incurable skin diseases will also be accepted at the farm.

The Virginia Society for the Study and Prevention of Malaria has compiled a booklet, "Seven Lessons on Malaria," for use in the schools. Prizes of from one to twenty dollars will be given the pupils presenting the best notes on the lessons.

The rats along the piers and water front in New York are being trapped and examined for *B. pestis*. Thus far results have been negative, but the work will be continued as long as there is any danger of the entrance of plague into the harbor.

The Macon (Georgia) Medical Society recently appealed to the mayor, council and county commissioners to provide more adequate means for the care of those suffering from tuberculosis and pellagra. Neither the Macon Hospital nor the Roff Home will admit poor patients of this class.

Maryland has been divided into ten sanitary districts by the State Board of Health. A physician will be in charge of each district and will be responsible for the enforcement of sanitary laws and the general health conditions of his portion of the state.

The American Association of Medical Milk Commissioners held its annual meeting in Rochester, N. Y., on June 19. Dr. Thomas C. McCleave, Berkeley, Cal., was elected president, and Dr. Julius P. Sedgwick, Minneapolis, was elected treasurer. The next meeting will be in San Francisco.

The Board of Health and several San Antonio medical societies have proposed an ordinance which will make the killing of bats within the city limits a misdemeanor. This is in line with the work Dr. Charles A. R. Campbell is doing in Texas in the eradication of mosquitoes by bats.

Dr. Simon Flexner and Dr. Peyton Rous, of the Rockefeller Institute, and Dr. Linsly R. Williams, deputy commissioner of New York State, have gone to Spartanburg, S. C., to join the Commission for the Study of Pellagra. Of 8,000 cases studied by the Commission, 28 per cent. have ended fatally.

The following officers were elected at the meeting of the National Mouth Hygiene Association held in Rochester, July 11: Dr. Harvey W. Wiley, president; Dr. W. A. Evans, Dr. Oscar Dowling, Dr. William R. Malone and Surgeon-general Rupert Blue, vice presidents; Dr. G. Ebersole, secretary-treasurer.

Dr. Fred M. Meader, formerly associate professor of bacteriology and pathology at Johns Hopkins, and then city bacteriologist of Syracuse, N. Y., and associate professor of preventive medicine and hygiene at the Syracuse Medical School, has become Director of the Division of Communicable Diseases of the New York State Board of Health.

A suit for \$25,000 has been brought by a citizen of Waterloo, Ontario. The claimant was vaccinated during the recent epidemic when the Ontario State Board of Health ordered a general vaccination. He claims that he has been in poor health since that time and that physicians have advised him that this ill health is due to the vaccination.

A public-spirited citizen of La Salle, Illinois, has founded a health center which includes the entire township and takes in the towns of La Salle, Peru and Oglesby. There will be a model high school and social center, with libraries, swimming pool and reading rooms. The school children will be inspected and the milk supply will be under control.

Following the example set in Topeka, the Kansas State Board of Health proposes to adopt a plan by which the children of each room will weekly select from their number a child who will have charge of the sanitation and ventilation of the room. This will not only teach proper methods of ventilation to the children, but will be carried by them into the home.

On July 1, the free health test of the Equitable Life Assurance Society went into effect. This may be taken advantage of by any person having held a policy for three years or longer, and includes tests made by the salaried physicians of the com-

pany. Adding six months to the life of each of the 500,000 policy holders would mean a total saving of 250,000 years.

A new bacteriological laboratory, with Dr. Oscar Teague in charge, has been established at the Quarantine Station in New York. Dr. Teague was connected with the Manila Bureau of Science and was the American delegate to the International Plague Conference in 1911. His wide experience with plague, cholera and other quarantinable diseases makes his particularly suited to such a post.

The health department of the City of Vera Cruz has been divided into three divisions: the military, civil and quarantine. Colonel H. P. Birmingham, chief surgeon, is in direct charge of the military division, while Major Theodore C. Lyster, Medical Corps, U. S. A., is in charge of the civil department of public health. Dr. R. H. Von Ezdorf, U. S. P. H. S., is head of the quarantine division.

The most recent gift of Mr. John D. Rockefeller, \$2,550,000, to the Rockefeller Institute of Medical Research, for the purchase of ground adjoining the present building, and for the erection, equipment and maintenance of additional laboratories, makes it the most richly endowed institution of its kind in the world. This last gift is in addition to the one of \$1,000,000 for the establishment of a department of animal research.

During one week in May, three vessels from China carried plague patients to Manila. Upon examination of two of these vessels at Manila, no cases were found, but later one case was reported in Manila, and when investigated was found to be a passenger of the lately arrived *S. S. Taisang*, and the other case was discovered when the *S. S. Rubi* reached Cebu. The third case was detected when the *S. S. Linan* was inspected by the quarantine officers at Manila.

One of the most prevalent diseases in Mexico is smallpox. In Vera Cruz during the month of May there were reported twenty-two cases and seven deaths. On May 18, the Health

Department started a general vaccination. Up to June 30, 41,404 of the 60,000 people in Vera Cruz had been vaccinated. The morbidity rate from smallpox has already shown an appreciable decline and for the two weeks before June 30, no cases had been reported.

In a recent lecture, Dr. Kenwood, professor of Hygiene and Public Health of the University of London, strongly advocated a special training for all those entering the dairy industry. Only by education and supervision and a demand on the part of the public for pure milk, could this at present practically universally dirty product be brought up to the standard. In the meantime low-temperature pasteurization seemed to him the best remedy.

Close upon the ceremonies of placing a memorial tablet to Mr. Joseph Chamberlain and his son, Mr. Austen Chamberlain, in the Hospital of the School of Tropical Medicine in London, came the death of the elder Mr. Chamberlain. It was principally through the efforts of Mr. Chamberlain, and later his son, and Sir Patrick Manson, that the foundation for the School of Tropical Medicine was laid. His death will be a severe loss to all England and especially to all interested in tropical medicine.

Several years ago there occurred at Canal Dover, Ohio, an outbreak of typhoid fever in which nearly all of the hundred cases were traced to the same milk route. An epidemic has again appeared and most of the cases are again believed to be caused by this same dairy. Stringent investigation on the part of the health officers have revealed no typhoid carriers in the family or employees of the dairyman, and the infection is supposed to be due to distributing milk in uncovered containers. From now on, the milk from this dairy will be pasteurized and all milk at Canal Dover will be delivered in sterilized bottles.

The first Child Federation Health Center has been opened in Philadelphia. A survey of a limited area in the Italian section of the city was made and 157 children under six years of age, belonging to 377 families, were found. The Federation has

taken the responsibility for the health of each of these children. A new house has been completely equipped, the first floor being used as offices and examining rooms, the second floor for registration, and the third floor for the use of the house-keeper. The roof has been made into a roof garden, with awnings and comfortable chairs, and may be used as a sleeping porch for sick babies. Dr. Charles V. Dorwarth is in charge, and physicians, nurses, interpreters, social workers and office assistants are on the staff.

Up to date there have been fourteen cases of plague in New Orleans, with three deaths, and fifty infected rats have been found. The work of cleaning and ratproofing the city is progressing and citizens are joining the U. S. Public Health Service and the State and City Boards of Health in helping to make conditions better and are doing much toward the final eradication of the rat.

The Citizens' Health Committee has appointed a supervisor for each ward, who will arrange meetings and lectures and personally superintend the cleaning in his ward. The women of the city have also formed leagues and will inspect restaurants, hotels, markets, etc., as well as furthering the interests of their respective neighborhoods. The entire force of the Department of Public Works is being used to haul away garbage, trash and any material likely to afford a hiding place for rodents, and the city has arranged for the purchase of automobiles to replace the old, expensive and slow method of hauling in carts.

Though a general vaccination proclamation has not been issued, everyone is being urged to call either at the Board of Health or at the Tulane School of Medicine, where the inoculations will be given without charge. As time passes and confidence in the vaccin is gained by the people, more and more are presenting themselves for the purpose of taking advantage of this prophylactic measure.

The patients at the Isolation Hospital are doing well under the new method of administering double doses of anti-plague serum. Assistant Surgeon R. A. Kearny, Assistant Surgeon Francis A. Carmelia and Acting Assistant Surgeon

Mark D. Holds have been added to the staff. Fumigation of all outgoing cargo, both on boat and train, is being practiced strictly. The cars are made ratproof, fumigated and sealed with the emblem of the United States Public Health Service. All bodies are inspected before burial is allowed, in order to discover any cases of plague that may not have been recognized by the attending physician, but thus far no cases, unless previously suspected, have been discovered in this way.

An additional service is being planned, through the local medical profession. A central medical auxiliary committee is to create a house-to-house inspection service with systematic survey and scoring of each residence, particularly directing attention to the observation of recent city ordinances on ratproofing and rat prevention. The health point of view will serve as an opportunity to make the visit of inspection an occasion of educational propaganda on the general situation and measures of activity for the individual householder.

Public Health Activity.

CINCINNATI.—Weekly Report of the Board of Health, June 20, 1914. Baby contests in former days meant the selecting of that child who was most perfect in face and figure. The idea has changed in late years and now the child is chosen not alone for beauty of face and figure, but also for physical and mental qualities most nearly meeting the standards set by scientists. The children receiving the prizes are not the only beneficiaries therefrom, for each mother whose child has missed the mark has learned wherein her child is defective and it becomes her object to remedy these defects, in hopes that at the next baby contest the prize may be awarded to her child.

MICHIGAN.—*Public Health*, published by the Michigan State Board of Health. Dr. Dudley A. Sargent, Director of Hemingway Gymnasium, Harvard University, contributes a paper on the relation of physical education to race betterment. The tendency of modern times is toward an extremely low birth rate among the higher class, while among the poorer class it is much larger. This, as the author says, is contrary to the law of the

survival of the fittest. To some extent this is due to human sympathy and to personal hygiene, which strives to conserve the life of every human being, no matter how weak and degenerate. This is in apposition to the principle of race hygiene, which strives for the elimination of the unfit and the betterment of the race. Physical education is instrumental in building up strong bodies and minds and in improving the physical condition of men and women, which means the improvement of the race.

NEW YORK.—Weekly Bulletin of the Department of Health, City of New York, June 27, 1914. We wish to quote in part a paragraph from this bulletin which has as its head "Watching the Health Department at Work." "Not so many years ago it was believed that the proper functions of a health department were limited to the registration and tabulation of certain vital statistics, to the abolition of nuisances, the inspection of premises in order to discover damp cellars, leaking cesspools, foul drains, etc., and to matter relating to the spread of the more readily communicable diseases, such as smallpox, diphtheria and scarlet fever. In accordance with this conception, the Department of Health of this city was organized into two bureaus, the Bureau of Records, and the Sanitary Bureau. Contrast all this with the modern conception of the duties of health authorities: Diagnostic laboratory work, production and distribution of anti-toxic sera and vaccins, performance of intubation, home supervision of tuberculosis, hospital and sanatorium treatment of tuberculosis, school medical inspection, intensive work in infant hygiene, supervision of midwives, control of the milk supply, bacteriological research, and organized public health education."

Oregon State Board of Health, Quarterly Bulletin, April, May, June, 1913. A ruling recently made in Oregon calls for the branding of the letter "T," to be at least three inches long, on the right jaw of all cows reacting to the tuberculin test. The former method was to fasten a metal tag in the ear of the cow, but dairymen often removed the ring and sold the cows as healthy animals. The small hole made by the ring was almost invisible and the cows thus disposed of could not be detected, but were

scattered over the country, to infect cattle in other localities. Under the new method, no such cows can escape observation. Another ordinance passed at the same time was one to compel all milk from tuberculous cows to be sterilized and the bottle labeled accordingly. This milk might be used for cooking, but to feed it to a baby would be criminal and by the label the public would know what it was buying.

CURRENT LITERATURE

BRIEF OF TRANSACTIONS OF THE "DEUTSCHE TROPENMEDICINISCHE GESELLSCHAFT," held in Berlin, April 6-9, 1914. (From the *Hamburger Medizinische Uebersehefte*, May, 1914.) Olpp reported upon tests made with Cantlie's tuning fork-stethoscope method of outlining solid organs. If a tuning fork is struck and placed over a solid organ, e. g., the liver, heart or spleen, and moved toward the periphery during auscultation with a stethoscope, the sound ceases as soon as the border of the organ has been passed. It proved particularly accurate for outlining the liver, less so for the spleen and heart. It seems particularly useful for outlining the liver in suspected abscess. Martini, the entomologist of the Hamburg Institute für Schiffs-u. Tropenkrankheiten, discussed some problems of the medical entomologist. He first discussed the unexplored fields of the transmission of amebic and bacillary dysentery, and believes that flies are the probable transmitters of the latter, it having been shown that the feet of flies are permanently moist, and thus would favor the viability of the Shiga bacillus. He alluded to Roubaud's hypothesis that certain races of *Glossina palpalis* and *Glossina morsitans* showed differential susceptibility in different climates and localities. He sees in the Panama Canal potential danger from yellow fever for Australia and Asia. In India the *Stegomyia fasciata* is found very extensively distributed. In northern and eastern Asia, the *Aedes scutellaris*, a very close "kin" to *Stegomyia*, is very plentiful. He considers that we need further investigations to determine which genera of Anopheles are proved alternate hosts of malaria. A *Jantinosoma* species is now looked upon as a carrier of the ova of *Dermatobia cyaniventris*.

Prof. Gabbi (Messina) reports upon contributions to the knowledge of Leishmanioses. By means of circularizing observers and on ground of personal observation, Gabbi is able to show that the cases of Kala-azar in Sicily and the countries of the Mediterranean appear principally in the spring. Since incu-

bation may be estimated at three months, certainly not longer, flies may be excluded as carriers. He was unable to corroborate Basile's hypothesis of flea transmission. Gabbi undertook to prove up the assertion of Nicolle, who claims that human and animal Leishmanioses belong to separate species. Indian dogs which never became infected spontaneously were infected with Italian *Leishmania infantum*. The results were identical with those in dogs infected with the Indian *Leishmania*.

Gonder demonstrated mice infected with *Leishmania tropica* infection, both from cultures and from organs, gave 100 per cent. of positive results. Thus far mice have been refractory to *Leishmania canina*.

Verruga Peruviana was studied by Mayer and de Roche-Lima. They found in one case observed in Hamburg certain inclusions within angioblasts which they regard as Chlamidozoa. Inoculations of monkeys have been successful. Mayer considers that the two stages, i. e., the stage of fever, during which the red cells show acidophile stipplings, and the stage of verruga, belong together.

Rodenwaldt reported upon the distribution of tropical helminths in Togo. Distribution depends upon geographic and climatico-meteorological conditions. Bilharzia was found only in the lowlands of the coast. *Filaria medinenis* did not occur in regions of prolonged drouth. *Anguillula stercoralis* and ankylostomata appear to increase with density of population. The remarkable findings were the absence of calabar swellings in Togo, of *Filaria bancrofti* in women, of *Necator americanus*, and the moderate prevalence of *Trichocephalus trichiuris* and of the *Oxyures*.—[To be concluded.]

Wm. Krauss.

NEOSALVARSAN IN LEISHMANIOSIS OF THE SKIN.—(*La Cronica Medica*, Lima, Peru, Nov. 30, 1913.) Dr. Guillermo Almenara reports his experience with the medicinal treatment of leishmaniosis of the skin. This disease is identical with Oriental sore, Biskra boil, Aleppo boil, and has received various names in different parts of South America: *uta*, *espundia*, *tiac-arana*. Dr. Almenara thus summarizes his conclusions: (1) Neosalvarsan, by intravenous injection, certainly modifies in a favorable man-

ner the ulcerous lesions of leishmanic origin, when combined with appropriate local treatment and correct hygiene. (2) This local treatment should be limited to moist applications, mildly antiseptic, with the object of keeping the ulcerating surface free from crusts, which might interfere with drainage. (3) The action of local applications is not sufficient to effect a cure, since they do not reach the limit of the infiltration of the germs in the tissues. (4) That the heroic measures, like cauterization and excision, are objectionable on account of the deformities they leave, or the reinoculations that they cause. (5) The ideal treatment would be a "vaccin," which would also be prophylactic since it would confer immunity. (6) In neosalvarsan by intravenous injection we have a reliable therapeutic resource in leishmaniosis. Almenara cannot share the opinion of some observers who abandon the patients in the hope of a spontaneous cure.

A. McShane.

ETIOLOGY OF SPRUE.—(*Bull. de la Soc. de Path. Exotique*, Vol. VII, No. 4.) A. Distaso reports the results of vaccin therapy in a case of tropical sprue. The clinical phenomena were distinctive and the stools were very acid and frothy. A smear was made from the stools and stained with Gram's method and fuchsin. The *Bacillus bifidus* was present in preponderating numbers; there were also *B. acetogenes* and a few Gram-negative cocci. A bacteriologist, not knowing the source of these stools, might take them for those of a nursing child. Cultures on Drigalski gave a few colonies of *B. coli* and a large number of colonies belonging to distant groups: the ones belonging to the group of *Lactis aërogenes*, and the others to the Friedlander bacilli. The latter have the following characteristics: On solid media they act like Friedlander's bacillus. In media containing glucose, lactose, mamite, raffinose, and levulose, there is production of acid and gas. They have no effect on saccharose, dulcete and calicin. Petruski's medium is liquefied. They coagulate milk, but in a few days the casein is digested on the surface and there are cracks in the coagulum. The milk looks like a turbid liquid. In tryptophan-media, indol is produced. This microbe is motionless. In neutral-red agar, it produces acid and

gas. As to fluorescence, it is negligible. Diastaso prepared the vaccine with that microbe. After the first injection of five million bacteria the patient reacted violently; he had thirty-nine stools; but, after the reaction, the patient did well. Seven days after, another injection was given, which caused all the symptoms of sprue to disappear; he even complained of constipation. Two other injections were given. One year after the last injection the patient was still in good health. No relapses had occurred. There can be no doubt, then, that his malady, which had lasted for twenty-one years, was completely cured. It is noteworthy that the intestinal flora gradually became more like the normal as the patient's condition improved. We feel justified in saying that there is a causal relationship between the microbe described and sprue. We call this organism provisionally *Bacillus sprue*.
McS.

CHOLERA IN CONSTANTINOPLE AND THRACE FROM 1910 TO 1913. —In the *Bulletin de la Société de Pathologie Exotique*, Vol. VII, No. 4, there is a very interesting article in cholera by P. L. Simond and Pasteur Vallery-Radot, with the collaboration of Kiamil Bey and Raphael Asseo. During the recent war in the Balkan states, cholera, dysentery and typhus exanthematicus claimed a large number of victims. The authors refer to a previous paper of theirs in which they ascribed an Asiatic origin to the cholera that appeared in Constantinople in 1910. The disease was brought to the Turkish capital by some recruits from Anatolia (Asia Minor), who took part in the grand maneuvers about seven miles from Constantinople. In the villages first invaded by cholera, around Lake Derkos, the country is swampy; and the water used by the people is thrown out on the ground and either lost by evaporation or else find its way to the lake. The dwellings are made either of stone or wood, and are usually of only one story; only a few have an upper story. There are no privies, vaults, or water-closets. The offal is thrown out into the garden or the yard or the roads. In some of the two-storied houses, there are projecting privies which overhang the street. These privies are devoid of means of carrying off the offal, which thus falls directly into the street. At night, the mattresses are

spread on the ground or the floor. When an occupant of the house falls sick, he is cared for in the common apartment. It is further to be noted that in certain religious sects there exists the custom of kissing the lips and hands of a dead person. All of the above conditions favor the spread of the choleraic contagion. At the same time, the disease broke out in Constantinople and the villages on the banks of the Bosphorus. In ten weeks there were 1,284 cases, with 753 deaths. The disease grew scarcer as the cold weather came on, and disappeared completely in midwinter. In the following spring, no cases developed in Constantinople and environs, in spite of the great heat and dryness. The authors searched for cholera vibrios in the dejections of former patients, expecting to find some "cholera-carriers," but their search was in vain. Sad times for the Turks again set in after their defeat by the Bulgarians at the battle of Luley-Bougas. On the retreat, provisions gave out; all sanitary precautions were neglected; and conditions were favorable for the spread of cholera. The men, exhausted from hunger and fatigue, slept on the cold, wet ground. They awoke with diarrhea, ripe for cholera. The epidemic reached its maximum from the 20th to the 30th of November. During this period the earth was strewn with corpses in such numbers that it was impossible to bury them all. Each day had its thousands of victims. Exact figures are impossible to obtain, but some military surgeons estimate the death roll from cholera in that outbreak at not less than thirty thousand. We pass by the interesting remarks of the authors on camp dysentery and typhus exanthematicus and pass to their conclusions concerning the mode of transmission of the cholera infection. The deplorable sanitary conditions referred to as prevailing in the villages around Lake Derkos are such as are found in nearly all other villages. Troops camped on the field or quartered in villages are not in any better condition, for they are crowded together in tents, sleeping on contaminated soil, drinking water from streamlets to which the rains carry all kinds of filth; in addition, the men were generally weakened by fatigue, hunger, cold and demoralization. In Constantinople, things were entirely different. The situation of most of the quarters of the city on steep hills facilitates the

evacuation of waters into the Sea of Marmora, the Golden Horn, or the Bosphorus. This evacuation is performed by a number of drains, although these are not quite as numerous as they ought to be, and by street gutters. The offal is carried off by another set of pipes, but not in all the quarters of the city. The water-supply is derived chiefly from Lake Derkos and the forest of Belgrade, the water being conducted through about thirty miles of tunnels, reservoirs, or open aqueducts. Other, but smaller, sources of supply are found in nearby springs, cisterns, etc. Lake Derkos is in the center of a former cholera district, but frequent bacteriological examinations of the water from that source and from the forest of Belgrade established the entire absence of the cholera vibrio from these two sources of water-supply. In short, in reviewing the facts observed in the course of the recent epidemics in Constantinople, the rôle played by the drinking-water in these outbreaks was really *nil*. Transmission of the disease was by direct contact: contact with the patients, contact with clothing and soiled objects, contact with soil saturated with infected dejections. Cholera seemed to the authors to be a disease transmitted chiefly by dirty hands, by hands soiled by virulent dejections recently discharged. The hands are the objects that are most generally the intermediary between soiled articles and the food and drinks which carry the vibrio to the system of the patient. The important part ascribed to contamination of the soil is supported by certain conditions that are found in regions in which cholera is endemic. In these regions, the people in general are poor and unused to habits of cleanliness; there are no privies or water-closets on the premises, as a rule; and the ordure is thrown on the ground around the home.

McS.

A NEW VARIETY OF THE PARASITE OF LAVERAN.—At a meeting of the *Société de Pathologie Exotique*, May 13, 1914, Ahmed Emin reported from the laboratory of Dr. E. Marchoux, the results of his examinations of a number of sick pilgrims at the lazaretto of Camaran, located on an island in the Red Sea. From forty to sixty thousand pilgrims pass through there every year, who come from China, the Straits Settlements, India, Persia,

and the East Coast of Africa. Before being permitted to rejoin the pilgrim bands, they are all subjected to an examination varying according to the sanitary condition of the country from which they come: either merely inspected and their goods disinfected, or else detained with their baggage for four or five days. The medical officers of Camaran devoted special attention in 1913 to the prevalence of malaria among the pilgrims. Among the sick pilgrims that they examined the greater number were carriers of the *Plasmodium vivax*; about one-tenth of them had in their blood *Plasmodium præcox*. According to Ahmed Emin, not once did they encounter the *Plasmodium malariae*. A few patients had a double infection of *vivax* and *præcox*. The point which Ahmed Emin desires to stress is that six of the patients contained in their blood large numbers of a parasite that has not yet been described. The young forms are found in numbers in the same blood corpuscle—as many as five at a time, although two or three are the rule. They consist of a thin ring of protoplasm and a granule of protoplasm. The nucleolus divides early. Two, or even three, grains of chromatin are frequently found. The protoplasm shows very active ameboid movements. The older and half-grown forms occupy about one-third of a red blood corpuscle. They consist of a protoplasmic mass with a nucleus lying loose in a clear vacuole. Some very fine pigment-granules are seen in the protoplasm. Division begins early. Parasites that do not measure more than half a corpuscle are seen, in which the chromatin has already undergone division. Division goes on rapidly and ends in the formation of a rosette which consists of from four to ten merozoites, and which is never more than three-fourths as large as a blood corpuscle. The amount of pigment is always small; and is gathered in a spot in the rosette with the greater part of the remains of the protoplasm. The products of the division remain in the corpuscle until maturity. The infested corpuscles are not increased in size and are not decolorized. However, they contain some granules of Schüffner, or, at least, some particles that stain as intensely as chromatin, and which are arranged around the parasite. Sometimes these bodies are filamentous instead of granular. The sexual forms, round in shape, enclose pigment in the shape

of little rods and usually occupy three-fourths of a corpuscle. Sometimes they are found free. Ahmed Emin thinks that this parasite deserves a distinctive name; he calls it *Plasmodium vivax*, variety *minuta*.

In the discussion on Emin's paper, Laveran said that Dr. Marchoux had forwarded to him a specimen of malarial blood from Camaran, showing the peculiarities to which Dr. Ahmed Emin draws attention. In Laveran's view, none of the forms of the parasites found in this specimen is new; it is merely the association of the various forms that is unusual. The forms described by Emin are merely intermediate forms, veritable transitional forms, which seem to Laveran a powerful argument in favor of the unity of paludism.

McS.

INTRAVENOUS INJECTION OF SUBLIMATE-SOLUTION IN TROPICAL MALARIA WITH LATENT SEPSIS.—(*Archiv. f. Schiffs-und Tropen-Hygiene*, January, 1914, 2 section. Dr. L. Deppe, government physician in Tanga.) In malarious districts, laymen are inclined to call any fever "malaria;" on the other hand, physicians find it hard, in the presence of a positive finding of the malarial parasite in the blood, to ascribe a fever to any other cause. An obscure case of fever in his district that resisted quinine was very instructive. A pregnant German woman, who had moved to the Tropics only ten months before, contracted a fever that recurred daily. The blood examination was negative in the morning, positive in the evening. She was admitted to the local hospital and at once put on quinine, which had absolutely no effect on the course of the fever. Her child was born during her stay in the hospital, but her fever continued long after the patient had recovered from the discomforts of child-birth. In a fit of desperation, Deppe resorted to Bacelli's method in "acute infections with doubtful diagnosis and latent infection-carriers;" that is, intravenous injection of corrosive sublimate. Whilst Bacelli repeats the dose three times in twenty-four hours, Deppe gave it to his patient only twice a day until five injections had been given; thereupon the temperature became normal and remained so. As an unlooked for side-result, the patient had loose bowels for a week, during which time she had seventy-three

"sublimate stools." The effect of this treatment was remarkable for its rapidity and thoroughness. McS.

DIATHERMAL TREATMENT OF LEPROSY.—(*Berl. Kl. Wochenschrift; Archiv. f. Schiffs-und Tropen-Hygiene*, No. 10, 1914.) P. G. Unna, Jr., says that although apart from chaulmoogra oil, we possess no specific agent for leprosy, still we can use a great number of remedies that act admirably in relieving the symptoms of the disease. Cases which obstinately resist these measures are much less frequently observed than cases of syphilis that resist mercury, arsenic and iodid of potassium. This is particularly true with regard to nodular leprosy, which was formerly looked upon as the most malignant type. In such cases, the sooner and more thoroughly we destroy the nodes with caustics, cautery or excision, the better for the patient. For the deep-seated, hidden foci, only chaulmoogra oil is available. The same holds true in tubercular leprosy. Recently, de Forest's method of bloodless incision of deep infiltrations and lymph-glands, as well as subcutaneous nodes and papules, followed by caustics, has become an approved treatment. For rapid and radical removal, this method is better adapted than cauterization with the Paquelin cautery and a bloody excision. On the other hand, it is worse in pure nerve leprosy and especially in those cases in which, together with discrete, pigmented anesthetic spots, there are hard, thick and somewhat painful cords, energetic local treatment of which often brings about new erythematous patches. For these painful cords we have until recently had very few remedies; the typical analgesics, such as camphor-chloral salve, belladonna; or antiphlogistic, such as ichthyol, tincture of iodine, pyrigallol, lead-lotion; or internal remedies, such as aspirin, strychnin, ichthyol. Occasionally, an attempt has been made to obtain a sedative effect by the injection of a 1 per cent. carbolic acid solution in the vicinity of the nerves. In general, Unna succeeded in bringing about a comparative cure only when the general constitution was improved by means of chaulmoogra oil. There is only one local application that we can measurably look upon as a specific for nerve-leprosy, and that is heat. Formerly, full

hot baths after the Japanese model were used for this purpose, or the flat method (Plättmethode) introduced by Unna, Senior. The latter gave excellent results, but it was not well borne by sensitive patients, and does not penetrate deeply enough into the tissues. Moreover, in anesthetic leprosy, the heating may be carried to the point of burning before the patient notices it. All heating-bottles, thermophores, etc., are open to the same objection. The electric thermophore-compress, which provides a uniform heat for a long time, is an important advance. Another forward step is the introduction of diathermy into the therapeutics of leprosy, by means of which approximately measurable quantities of heat and electricity can be sent into the degenerated and hardened nerve-cords. Basing himself on seven cases, Unna concluded that diathermy allays the pains of leprosy in a striking manner. With longer treatment we can effect a cure of deep-seated infiltrations in a shorter time than by external heat applications. Furthermore, it seems to be a good adjuvant to every general treatment of nerve-leprosy, since it softens the thickened, indurated, bacilli-laden nerve-cords, and thus prepares them for the action of the chaulmoogra oil.

McS.

LEPRA-BACILLI IN LYMPHATIC GLANDS OF APPARENTLY HEALTHY PERSONS.—In a letter from Dr. Couvy to Director of the Bureau of Hygiene of Grand Bassam, published in the *Bulletin de la Société de Pathologie Exotique*, No. 5, 1914, some interesting facts are given concerning latent leprosy that should serve to stimulate our efforts to control that dread disease. He states that he recently had occasion to examine a native soldier who was suffering from leprosy. The patient said that the disease began with spots on the skin early in 1913, and progressed very rapidly; but this is not probable, for the patient presented ulcers containing Hansen's bacilli; perforating ulcer, and the claw-hand. This man was isolated at the leprosy of Bingerville. The examination of his environment brought out some interesting facts. His wife, who lived with him for a year, seemed to be perfectly healthy on examination: there were no spots on the

skin; no anesthetic or hyperesthetic areas; no modification of the reflexes; no perceptible nodosities along the course of the nerves. She had never had any febrile attacks. She consented to having her lymphatic glands punctured. The exploring needle brought nothing abnormal from the cervical, epitrochlear, right or left inguinal (lower) glands; but some lepra-bacilli were found in a smear made from the pulp extracted from the genital group of the left inguinal glands. The puncture had been made with a large needle and the ganglion had been vigorously kneaded. No information could be obtained on the hereditary or family history of this woman; but, strange to relate, six months before that time, her husband had had a sore on his penis. She denied that she had ever had a chancre or other venereal affection.

Dr. Marchoux, who read Couvy's letter to the Society, remarks that this case is a confirmation of the theory that he put forth concerning the primary infection of the lymphatic glands in leprosy, and similarity in the evolution of human leprosy and rat leprosy. This case takes rank with those of Lebœuf, Sorel, and Lebœuf and Javelly.

McS.

COCKROACHES AND ANTS AS CARRIERS OF THE VIBRIOS OF ASIATIC CHOLERA.—(*Philippine Jour. of Science*, Vol. IX, No. 1.) Barber presents interesting experimental evidence of the transmission, vitality, retention of virulence, and longevity of the vibrio in the alimentary canal of the common cockroach, *Periplaneta americana*, Linn., conducted under rather artificial conditions, but demonstrating possibilities which may later be found and accepted as facts, thus increasing our knowledge of this dreaded infection. Cultures and feces containing cultures were exposed to starved insects, which readily devoured them, and the organisms were later demonstrated in the feces from six to thirty-six hours after ingestion. Some specimens proved fatal for guinea pigs in a few hours, which is convincing evidence of the retained virulence after their passage through the intestines of the insects. Ordinary red ants, probably belonging to the species *Monomorium latinode*, Mayr, were also used, but owing to the small amount of feces obtainable the experiments were

difficult to perform, although eight hours after ingesting contaminated material the organisms were demonstrable in their intestines.

P. L. Querens.

THE TREATMENT OF THE INSANE IN THE TROPICS.—(*New York Med. Jour.*, Vol. XCIX, No. 21 and No. 22.) Woodbury, under the title of "Impressions of a Traveler," comments upon the treatment of mental deficiencies as observed by him in the various tropical institutions visited, including those of the Barbadoes, Jamaica, Porto Rico, Panama, Cuba, Bermuda and Trinidad. The therapeusis is mainly hygienic, very little use of drugs being adhered to. In some instances, complications of infectious diseases, such as tuberculosis and leprosy, were rigidly quarantined from the noninfected, while in others there was no strict segregation, although the living quarters were separated. Among the causes most commonly considered in the etiology of insanity in the Tropics, heredity as evidenced in epilepsy is thought to be most common; pellagra is given a prominent place, but alcohol, syphilis and temperature are given minor rôles. In some cases the governments have full charge, the institutions being public, though pay patients are admitted and receive attention consistent with the amount expended, which is usually less than the output, on account of the individual governments defraying the differences. The author was courteously received in all places visited, and comments upon conditions with which he, to all appearances, seems well pleased, and gives considerable encouragement for the future of these isolation hospitals.

P. L. Q.

RAT DESTRUCTION AND PLAGUE.—(*Indian Medical Record*, Vol. XXXIV, No. 4, 1914.) Browning Smith logically argues that the elimination of plague is proportional to rat destruction, and offers valuable statistics in defense of same. In the areas where the rats were poisoned once or twice, the plague mortality was 3 per cent., and those poisoned more than twice, the mortality was 1 per cent., while in those areas where no poisoning was done, the mortality was 5 per cent., giving sufficient evidence

of the effectiveness and encouraging results of rodent destruction. Rat trapping is tedious and uncertain and eliminates dangers encountered in poisoning, but poisoning under strict observation cannot be equalled and the majority of dangers associated with it can be eliminated, provided the coöperation of the populace is gotten. The best mixture that has stood the test of efficiency is a formula containing phosphorus, which can be economically produced. The author promises to give anyone the formula and directions for the asking. P. L. Q.

A PRELIMINARY REPORT OF EXPERIMENTS ON THE CULTIVATION OF THE VIRUS OF RINDERPEST IN VITRO.—(*Philippine Jour. of Sci.*, Sec. B, Trop. Med., Vol. IX, No. 1.) Boynton reports the successful artificial cultivation of this organism by a modification of the method of Bass and Johns, used for the malarial plasmodia. The modification consists of the salt-peptone mixture of Nencki, Sieber and Wijnikewitch, which is composed of 900 cubic centimeters of water, 100 grams of Witte's peptone and 20 grams of sodium chloride and modified by adding 0.1 cubic centimeter of a 33⅓ per cent. solution of glucose to each 10 cubic centimeters of the peptone solution. The medium is then placed in test tubes 1.5 centimeters in diameter and 15 centimeters in length, sterilized, and to which is added 1 cubic centimeter of defibrinated blood of a normal animal obtained under aseptic conditions. The tubes are then inoculated with 0.5 to 1 cubic centimeter of infected blood and absolute anaërobiasis obtained by covering the surface with from 1.5 to 2 cubic centimeters of sterile paraffin oil, then incubating at 40° C. It is interesting to note that the virus gradually loses its virulence if not transplanted in from 4 to 6 days, and in one series virulence was absolutely lost in 12 days, but the transfers proved virulent to susceptible animals. We await with interest further notes on this valuable work. P. L. Q.

THE BEARING OF ASSAM TEA GARDEN EXPERIENCE ON THE PROBLEM OF THE ETIOLOGY OF KALA-AZAR.—(*Indian Med. Record*, Vol. XXXIV, No. 5, May, 1914.) Leonard Rogers advocates

the theory of bedbug transmission as the most plausible in the etiology of kala-azar. Observations on coolies working in the tea industry revealed the fact that in isolating the infected cases, by allowing them to remain in the infected colonies and placing the noninfected in a different colony, practically and in some instances absolutely eliminated the disease from the healthy colonies, while the disease continued in the infected parts. The healthy colonies were separated only a short distance from the unhealthy, nevertheless no new infections appeared until newly imported coolies were allowed quarters in the healthy parts. Disinfection of the infected parts, thereby killing the bedbugs, decreased the mortality still further. The distance between the colonies was too short to prevent the transmission of the disease by an aerial insect—if any exists—which disperses this possibility, therefore the bulk of evidence incriminates the homely bedbug, which has been suspected for some time past.

P. L. Q.

FIRST REPORT OF THE NORTH MANCHURIAN PLAGUE PREVENTION SERVICE.—(*Jour. of Hygiene*, Vol. XIII, No. 3, Oct. 24, 1913.) Wu Lien-Teh (G. L. Tuck), in his first report, deals mostly with the tarbagan (*Arctomys bobac*, Schreb.), which was formerly considered as the chronic carrier of plague, it (plague) occurring as an epizootic amongst these marmots. The reports of the animals dying in great numbers, due to some chronic affection, were readily investigated, but the author found no proof in these reports, he having arrived in the reported areas a few days afterwards finding no evidence of any epidemic. In the paper the habits, distribution, hibernation, methods of capturing, killing, skinning and handling the animals, are treated in detail, and the author concludes that there is very little evidence in considering the animal as the most probable disseminator of this disease. The bulk of the attention should be centered upon the rat, on account of its proximity to human beings, and domestic habits. While the tarbagan is susceptible to plague when artificially infected, no animals were found which were naturally infected. Furthermore, the author encourages the

protection of the animal from a commercial point of view, its fur and flesh being valued very highly. Experiments with the fleas (*Ceratophyllus silantievi*) and ticks (a species of *Rhipicephalus*) found as parasites on the animals, showed no after effects after allowing the former to bite human arms, and the ticks refused to bite after being starved eight days, on one occasion.

P. L. Q.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editor as of special interest to the readers of this JOURNAL will be reviewed.

Arquivos do Instituto bacteriologico Camara Pestana. Tome IV, fase. II. Lisbon, June, 1914.

BOOK REVIEWS

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MANAGING EDITORS

CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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EDITORIAL

The Louisiana Leper Home and Its Work.*—The Legislature of the State of Louisiana in 1894 enacted a law making provisions for the compulsory segregation of lepers in the State of Louisiana and created a Board of Control in charge of the State's Leper Home to which those afflicted with leprosy should be sent.

Prior to that action of the Legislature, leprosy was a reportable disease (since 1890) under penalty, but no provision had been made for the care of lepers.

The Leper Home was opened on the first Saturday in December in 1894, with ten inmates, all in more or less advanced stages of the disease. Of the original ten cases but one survives, now twenty-nine years of age, with the disease arrested. Up to April 16, 1914, the date of the biennial report* of the Board of Control

*Tenth Biennial Report of the Board of Control for the Leper Home of the State of Louisiana, 1914.

to the Legislature, in the tabular statement of Dr. Ralph Hopkins, the visiting physician, there are totalled 219 admissions during the twenty years of the Home's existence; there are now 87 inmates.

The number of cases of leprosy which have been admitted and cared for in the Leper Home during the twenty years of its existence has more than justified the creation of the Home. The tax on the State has been large, of course, but also justifiable for more than one reason. Perhaps no one factor in creating general notice of leprosy has accomplished more than the work of the Louisiana Home. The lack of provision for proper laboratory detail and the absence of scientific interest in the disease on the part of the administration of the Home has prevented a broader usefulness. The early conviction that the State intended this as an asylum rather than as a hospital prevented the arrangement of the Home on any other lines. Success in treatment has resulted from more or less routine in following the plan outlined by the writer as long ago as 1896, and the patients who have been discharged as cured from the Home have practically all been cured by the use of Chaulmoogra oil, strychnin and hot baths.

The Louisiana Leper Home has demonstrated that even with fair care, reasonable treatment and good food and hygiene, some cases will get well; with more systematic and regulated treatment under strict disciplinary rules, better results might obtain.

Dr. Hopkins declares that the "treatment which has stood the test of time and has almost become routine for those who have a sufficient tolerance, consists of chaulmoogra oil in large doses, strychnin and hot baths." Various other remedial agents have been employed by him from time to time, but without results of note. Vaccins have been tried but the results do not warrant any definite estimate of their value.

The admissions to the Louisiana Leper Home in 1913 were 25, almost all of whom went voluntarily on the advice of the physicians recognizing the disease; occasionally commitment by legal process through the Board of Health report is necessary.

It has become more and more evident to the student of leprosy in Louisiana that the disease is on the increase and without the Leper Home there would probably have been more cases now than there are. Not all the cases in the Louisiana Home are from Louisiana. Cases from other States and even other countries have come indirectly by establishing brief residence in Louisiana.

Leprosy, however, is now of frequent occurrence in other States. Texas and Mississippi, bordering Louisiana, send their cases over, or these unfortunates drift to a point of refuge.

The Louisiana Home has served its purpose in demonstrating the need of segregation and the possibilities of treatment and care under such separation. But before the Louisiana Leper Home becomes the haven of lepers from the whole of the United States, the national government should have an asylum large enough to care for the lepers of the entire country, including those of Louisiana.

Isadore Dyer.

The Plague Situation in New Orleans.—On September 3, there had been 25 cases of human plague in New Orleans, all of the pestis minor type—excepting the earliest cases, which may have been bacteriemic; of these four have died and all but four have been discharged as cured. Since the disease has been promptly recognized, all cases have been isolated in a special building under efficient medical and nursing charge, and to all cases large doses of anti-plague serum have been administered. The prompt report of all suspicious cases is practiced and no person who has died in New Orleans is buried without an in-

spection of the body by a qualified medical officer. The situation medically is well in hand.

Of rodent plague on September 3 there had been 85 cases, practically all captured within the infected district. At last report over 100,000 rats had been taken, averaging about 9,000 per week.

Comprehensive city ordinances have been promulgated covering disposal of garbage and the ratproofing of premises, and all over the City of New Orleans there are active evidences of the fulfillment of the law.

The City Department of Public Works has efficiently removed refuse from the premises of about two-thirds of the city, and the work has been made more thorough by the coöperation of individual citizens cleaning the premises under ward and district organizations. The clean-up goes on and the medical profession is coördinating plans for inspecting every house and all grounds with a view to a complete health survey of the city, systematically scoring each individual house and grounds.

Altogether the situation is good and, in the opinion of the Federal officers in charge, more advanced than in any community similarly attacked by the plague.

There is no false sense of security among the people, who have already been awakened to realize that there is much yet to be done and that the deratization of New Orleans is a long way off and that the end will more than justify the time, trouble and expense entailed.

There has been no interruption in traffic either in New Orleans nor in incoming nor outgoing transportation. All precautions are taken and shipping is thoroughly fumigated before leaving port. For the week ending August 29, 81 vessels were fumigated with sulphur and 15 with carbon monoxid. Three thousand nine hundred and twenty-five cars were inspected and

1,230 cars were ratproofed. A significant fact may be noted, that there were no rodents killed in the cars treated.

The general public has at no time been seriously alarmed, though there has been no attempt at underestimating the conditions. The absolute control of the medical situation, however, and the thorough coöperation with the Public Health officials, makes the outlook certain—no matter how long it may take.

Isadore Dyer.

ORIGINAL ARTICLES

ANTS AND BEES AS CARRIERS OF PATHOGENIC MICRO-ORGANISMS.*

By

WILLIAM MORTON WHEELER, Ph. D.,
Bussy Institution of Harvard University.

The recent work of physicians and entomologists has convinced us of the fact that insects are very active agents in the dissemination of disease. That it should have required so much investigation to establish this conviction is rather surprising, when we stop to consider that we have long been familiar with the fact that many insects regularly act as definite agents in the dissemination of living organisms much larger than disease germs, namely, the pollen grains of flowers. Still the splendid investigations which have elucidated the relations of insects to malaria, yellow fever, sleeping sickness, bubonic plague, etc., merely bring us to the threshold of a vast and very intricate subject, the adequate investigation of which will probably tax the powers of several generations of biologists. The transmission of diseases by blood-sucking insects has been the first to yield to investigation because the habits of these insects are highly specialized and therefore very definite and comparatively easy of experimental control. The vector rôle of the house fly is much vaguer, but its great abundance and wide distribution have been important aids in placing our knowledge of its behavior on a firm basis. But what are we to say about many other species of insects, which may be less abundant, of much more generalized or more versatile behavior and whose contact with man may be merely occasional or confined to restricted localities? We cannot dismiss these insects as unimportant, though we shall often have nothing but vague conjecture or suspicion to guide us in their investigation and shall soon acquire the conviction that we must frequently follow paths that end either fruitlessly or against baffling obstacles. Hence you will

*Read at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held in Boston, May 29, 30, 1914.

pardon me if in the following paper I fail to contribute positive experimental data and merely give expression to conjectures based on observation of certain insects which I believe will eventually occupy much more of the attention of sanitarians and entomologists in the Tropics.

Among household insects of primitive and versatile habits and possibly of considerable importance in conveying germs are the cockroaches and ants which, though as abundant as fleas, bedbugs, house flies and mosquitoes, at least in the Tropics, have received very little attention from sanitarians. The cockroaches are, in many particulars, the most ancient and primitive of existing insects. They are nocturnal, gregarious, omnivorous and decidedly thermophilous, or warmth loving. This last peculiarity accounts for the fact that nearly all the species are confined to tropical or subtropical countries, and that even the common domestic roaches cannot live out of doors in temperate regions. That insects which will devour any sufficiently soft substances from human foods and the feces of other cockroaches, to glue, grease and water colors, and live by preference in the cracks of the floors and walls of houses, bakeries, restaurants, sugar refineries and tanneries, where their bodies come in contact with the filth and refuse that necessarily accumulates in such places, should carry a host of germs about both on and in their bodies and be able to infect our foods, is certainly not surprising. Still there is no experimental evidence of this ability on the part of the large and abundant tropical roaches. The only evidence I have seen was collected by Longfellow,¹ who found that one of our northern roaches (presumably *Periplaneta orientalis*) will not only carry on its legs *Bacillus coli communis*, *Proteus vulgaris*, *Staphylococcus aureus* and *citreus* and a bacillus of the *subtilis* type, but that it is easy to cultivate from the roach's feces with undiminished virulence such organisms as the Westbrook type of diphtheria bacillus, *B. prodigiosus*, *violaceus* and *pyocyaneus* and both the *Pneumococcus* and *Meningococcus*. According to Longfellow, roaches probably also feed on tubercular sputum and disseminate the bacilli in their

1. The Common House Roach as a Carrier of Disease. *Amer. Jour. Publ. Health*, LIII, No. 1, 1913, pp. 58-61.

feces as readily as the common house fly. The danger, indeed, in this case is very great, owing to the fondness of the roaches for dark places such as basement rooms and cellars, where conditions are such as to keep the sputum from drying up and prolong the life of the bacillus.

Ants are often abundant about houses and even on ships. Several of the species, disseminated by commerce, have established themselves in all parts of the Tropics, where they live quite as readily out of doors and at some distance from settlements as in dwellings and shops (*Iridomyrmex humilis*, *Nylanderia longicornis*, *Monomorium destructor* and *pharaonis*, *Pheidole megacephala*). Some of the species, when introduced into temperate regions, survive only in hothouses (*Tetramorium guineense*, *Nylanderia vividula*, *Technomyrmex albipes*, *Pheidole flavens*, *anastasioi*, etc.). On the other hand, in certain localities native species readily invade the dwellings of settlers and thus become house ants (*Camponotus pennsylvanicus*, *Monomorium minimum* and *Solenopsis molesta* in the United States, *Solenopsis geminata* throughout the American Tropics, *Camponotus nigriceps* in Australia, etc.). Under these circumstances ants are certainly a serious pest as they visit and get into food and naturally lead one to suspect that they may act as carriers of pathogenic organisms. I find only a few references to this subject in the literature, however, one to *Monomorium destructor*, gravely suspected as a disseminator of bubonic plague in India, and a paper read by Dr. Darling at the recent meeting of the International Congress of Hygiene and Demography on some Panamanian ants.² Those who have observed ants in the Tropics will at once agree with this author when he says: "One can readily see the danger of our situation if ants acted as carriers of pathogenic microorganisms, for it is absolutely impossible to keep them out of the house and they get into food in spite of all our efforts. If this were all, it would not matter much, but they get into other things as well. During the dry season, they visit the water closets and bathroom in search of water, and the

2. The part played by flies and other insects in the spread of infectious diseases in the Tropics, with special reference to ants and to the transmission of *Tr. hippicum* by *Musca domestica*. Trans. 15th Intern. Congr. Hygiene and Demography, Sect. V, Washington, 1913, 4 pp.

winged form of ants fly where they cannot creep. In fact, it would seem as if there were not a point on the earth's crust within the Tropics that is not carefully inspected within the course of an hour by some industrious, persistent and inquisitive ant." Darling performed two series of experiments for the sake of determining whether ants could carry *Bacillus typhosus* in their alimentary tracts or on the surfaces of their bodies. He found that "when ants were immersed in a broth culture of *B. typhosus*, then permitted to crawl over filter paper within a Petri dish for five minutes, and afterwards placed in a sterile Petri dish lined with filter paper, they were able, as long as 24 hours after removal from the broth, to infect culture media by simply creeping over it." The other series of experiments gave negative results, for after dissecting ants that had been fed typhoid bacilli, neither these nor any other microorganisms could be cultivated from the intestinal tract. From these results Darling proceeds to draw an erroneous conclusion which can only be due to ignorance of the anatomy and physiology of ants. He tested his ants for formic acid and found that two of the species with which he worked (*Camponotus zonatus* and *Tetramorium guineense*) contained 2.1% of this substance, and he believes that because its germicidal value is four times as great as that of carbolic acid, the "ants may effectually sterilize bacteria in their food." Though not definitely stated, it seems that Darling supposed the formic acid to be secreted in the alimentary tract of the ant, which is, of course, erroneous, and he seems to believe that this acid is generally present in ants, whereas it is produced only by certain genera and species.

When the ants are again studied as carriers of disease germs it will be necessary to pay some attention to their peculiar method of feeding. Ants live only on liquid food, either imbibed directly or sucked out of minute solid or semi-solid particles which have been rasped off by the tongue and pressed into a little pocket on the ventral side of the pharynx. The liquid thus expressed passes back through the œsophagus into the crop, or "social stomach," so called because it may thence be fed by regurgitation to other ants or to the larval brood. Later the little dry pellet is spit out of the subpharyngeal pocket.

This pellet also contains the dirt scraped by the ant from its own legs and body by means of the tibial strigils, or combs, which are cleaned from time to time by being passed through the mouth. Hence the pellet may contain all kinds of microorganisms and fungus spores collected from the outer surface of the body in addition to any that may have been contained in the solid food. As the ants may drop the pellets anywhere, even into the human food they are so fond of visiting, infection may result much more directly than Darling supposed. Of course, any microorganisms imbibed into the crop with liquids would either be fed to other ants by regurgitation or pass on through the alimentary tract, first into the "individual" stomach and then into the intestine, to be finally voided with the liquid feces, but under no circumstances would the microorganisms necessarily come in contact with the formic acid of the ant's repugnatorial glands. It would seem to be possible, therefore, for ants to spread disease germs in three different ways: first, by simply walking over or into human food, as Darling has shown; second, by dropping into it infected hypopharyngeal pellets, and third, by contaminating it with their germ-laden feces.*

An account of the various house ants would be out of place here, but there is one species, *Solenopsis geminata*, that is so abundant throughout the Tropics of both hemispheres, so versatile in its behavior and therefore so typical of the kind of insects that have complicated and perhaps dangerous relations to man, that I cannot omit a brief sketch of its habits. *S. geminata* is a small ant, represented by several subspecies and varieties, varying greatly in the size, or polymorphism of the worker caste, and in color, from black to bright red. It stings so severely that in the West Indies it is commonly known as the "fire ant." It forms populous colonies, which nest by preference in open, sunny places, in more or less cultivated, loamy or sandy soil, especially about dwellings, and is fond of entering houses. It is a common tenant of the gardens in the patios of houses

*That the contents of the hypopharyngeal pocket may contain living organisms, capable of growth after the pellet has been expelled, is shown by the fungus-growing ants (Atti) of tropical America. The queens of these ants have been shown by H. von Ihering and J. Huber to start their fungus gardens with the hypopharyngeal pellet which contains fungus hyphae from the maternal nest.

throughout Latin America. In certain places in Costa Rica I have been tortured while lying in bed by the crawling and burning stings of the small workers. Its behavior exhibits a more bewildering diversity than that of any other known ant, for it is not only highly carnivorous, but attends scale insects and leaf hoppers for the sake of their saccharine excrement and even collects and stores seeds in its nests like a true harvesting ant. In Texas I have known it to sting young chickens to death when they happened to be confined in a coop near its nest. In the same State it is helpful in destroying the boll weevil and other insects injurious to cotton, but is sometimes a pest in gardens when it takes to gnawing holes in strawberries. H. Von Ihering has described the extraordinary method of migration to which this ant resorts in the Brazilian river bottoms whenever its nests are inundated.³ At such times all of the workers of the colony form a compact, cake-like mass, enclosing the brood and sexual forms in its center, and permit themselves to be carried along passively on the surface of the stream. When the colony strikes land, even after prolonged immersion, it scrambles out of the water and proceeds at once to establish a new nest. Some observations of my own in Guatemala a few years ago show that this ant has hitherto unsuspected habits. One day at Quiriguá, on a camping ground recently deserted by a band of negro woodcutters, I was surprised to find a number of *geminata* nests containing large numbers of full-grown fly larvæ. These were somewhat contracted and had evidently been stung and then stored as food as if they had been so many seeds. On following the ants I found that they were busily visiting masses of human excrement at the edge of the camp, extracting the fly larvæ and carrying them home. This reminded me of a brief note sent me many years ago by Capt. Perry C. Jones, at that time stationed at the Division Hospital in Manila. Capt. Jones stated that "the rarity of flies in the Philippines as compared with the United States is very evident from personal experience in the camps at Jamestown and Pasay. In the course of some experiments on flies it was accidentally discovered that a certain

3. Die Ameisen von Rio Grande de Sul. Berliner Ent. Zeitschr.. XXXIX, 1894, pp. 321-446.

kind of ant is very active in the destruction of the fly larvæ." He concludes that "these observations may have a practical bearing in regard to the small percentage of typhoid fever in these islands."* I have no doubt that Capt. Jones' observations relate to *S. geminata*, a red subspecies of which (*rufa* Jerdon) is common in the Philippines. It is evident that this peculiar habit, like so many of the habits of ants, has a double economic aspect, since the insect is beneficial in destroying the fly larvæ but at the same time in doing this it may become as injurious as the flies themselves. Certainly in insanitary conditions like the one I observed, situations which abound in the Tropics, the ants could hardly fail to transfer such organisms as the *Bacillus typhosus* or the spores of *Entamæba* from feces in which they might occur, to any exposed food in the immediate vicinity and thus cause an outbreak of typhoid fever or dysentery.

As a further instance of the unsuspected relations of man, insects and pathogenic organisms in the Tropics, I may cite a few observations on the stingless bees of the genus *Trigona*. The numerous species of this group throughout tropical America build in hollow tree trunks or in the ground peculiar nests of a brown or black substance known as cerumen and consisting of wax secreted by the insects and kneaded up with foreign substances which they collect. Some of the species use moist earth collected along streams and drains, others the feces of animals or man (*T. bipunctata*, *amalthea* and *ruficrus*). I have seen *T. ruficrus* in great numbers at Gatun, C. Z., visiting garbage barrels in company with house flies and blowflies, and *T. bipunctata* at various places in Guatemala collecting human excrement in open latrines and along railway tracks. That some of these bees will collect any strong smelling, semi-liquid substance was shown at Gatun, where I saw a swarm of *T. pallida* eagerly collect the crude black oil from a bucket that had been filled for use in exterminating mosquito larvæ. When we consider that the honey stored by various stingless bees in their

*Dr. W. P. Chamberlain, whom I consulted in regard to this matter, confirms Capt. Jones' statement concerning the relative scarcity of flies in the Philippines, but states that typhoid fever is now known to be common among both the native and white population of the islands.

cerumen cells is eagerly collected for food by the natives in many parts of tropical America and that there are records of intestinal disorders or even death following the eating of such honey, we are led to suspect that we may have here another case in which human food has been contaminated by filthy insects with pathogenic organisms derived from human or animal feces. At any rate, physicians and entomologists in the Tropics may find it necessary to study the habits of these bees and perhaps to teach the natives not to eat their honey till it has been sterilized by heat.

In conclusion I may call attention to a vast field in which insects are certainly very actively injurious. I refer to their rôle as disseminators of diseases among plants. That insects often carry fungus spores and even infect living plant tissue with them is certain, but to what extent is still unknown. Petri claims in a series of papers (1904-1906) that the olive fly (*Dacus oleæ*) inoculates the fruit of the olive with a bacillus that lives symbiotically in the alimentary tract of the fly, and Parrott has recently ascertained that our common tree crickets of the genus *Ecanthus*, while ovipositing, regularly infect apple trees with canker. It has long been known that the ambrosia beetles infect the walls of their burrows with wood-staining and therefore wood-damaging fungi. Neger has shown that certain gall flies, during oviposition, inoculate plants with fungi and that the larvæ of the flies feed on these same fungi in the galls. There is a strong suspicion that the extremely minute spores of the fungus blight, which is destroying all the chestnut trees in the Atlantic States, is frequently borne by insects. Wherever, in fact, the insect body comes in contact with living vegetable tissue, we have given the possibility of the infection of the latter with fungus and bacterial diseases. But there is at least one other more indirect source of plant infection due to peculiarities in the behavior of certain insects. All the species that habitually suck the juices of plants, like the plant lice, scale insects, psyllids, cicadas, etc., void great quantities of liquid, saccharine excrement, known as "honey dew," over the surfaces of the leaves and twigs, and this substance forms an excellent medium in which many plant-destroying fungi can begin

their growth. At this point we find that the ants may intervene in a double economic capacity, for they often protect the plant-sucking insects and their young for the sake of their sweet excrement and are therefore indirectly injurious to the plants, but they are beneficial in protecting the plants from many of their fungus parasites because they drink up the honey dew before it can fall on the foliage.

We used to smile at Huxley's story about the pollination of red clover depending on the number of bumblebees, the number of bumblebees on the numbers of their enemies, the field mice, the number of these on the number of cats, and the abundance of cats on the number of old maids in a rural community, so that the spinsters were unconsciously responsible for the success of the clover crop in their neighborhood. Now we should regard such a concatenation of organisms with interlocking activities as a matter for serious investigation and call it a "biocænose," since we have learned something about other cases even more extraordinary, like the meadow snail-liver fluke-sheep, the rat flea-*Bacillus pestis*-man, and the mosquito-*Plasmodium malariae*-man biocænoses. We may indeed venture the statement that the scientific study of the various biocænoses in which man or one of his domestic animals or plants is one of the coöperating organisms, constitutes the true foundation for the application of economic biology. It would follow that the sanitarian might be defined as an economic biologist who applies in practice the results of a study of those biocænoses in which not only man but some parasitic or pathogenic organism is involved.

**OBSERVATIONS UPON THE MORPHOLOGY, LIFE CYCLE
AND RELATION TO DISEASE OF ENTAMÆBA
HISTOLYTICA.***

By

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In the following contribution a summary will be given of the morphology, life cycle and relation to disease of *Entamæba histolytica* based upon the most recent observations of this interesting and important parasite. No attempt will be made to describe in detail the minute morphology of the parasite or to give the minutiae of the experiments that have established its pathogenic nature, but only to give the most important points regarding its life history and those which are of the greatest value in the differentiation of this species from other intestinal entamæbæ.

***Entamæba histolytica* Schaudinn, 1903, emend Walker, 1911.**

This, the most common pathogenic entamæba of man, was first differentiated by Schaudinn,¹ although it had been studied and partially described by numerous observers prior to his investigations, notably by Kartulis,² Jurgens,³ Councilman and Laffeur,⁴ and myself,⁵ under the name *Amæba coli*, or *Amæba dysentericæ*. Schaudinn described the parasite as showing a clear distinction between the ectoplasm and the endoplasm; a nucleus, generally invisible in the living specimen, possessing a very delicate nuclear membrane and minute karyosome; while it reproduced by simple division and budding, or gemmation, small amæbæ being budded from the parent organism. The latter process is now known not to be reproductive in character, but degenerative, *Entamæba histolytica* really repro-

*Read by title at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held in Boston, May 29, 30, 1914.

ducing by simple division and by the formation of four daughter entamœbæ within a resistant cyst. Schaudinn failed to recognize these cysts as connected with the life cycle of this parasite, although he was aware of their occurrence in his material, and he also failed to note the occurrence of two distinct types of nucleus occurring at definite stages in the life cycle of this entamœba. These facts were first noted by Walker,⁶ who proved that the so-called *Entamœba tetragena*, which possessed a definite type of nucleus and reproduced by the formation of four nucleated cysts, was in reality merely different stages in the development of *Entamœba histolytica*, and that the process of reproduction by budding, or gemmation, described by Schaudinn, is a degenerative process noted especially in the entamœbæ found in the feces of long standing cases of entamœbic dysentery. At the present time it is recognized that *Entamœba histolytica* includes the so-called *Entamœba tetragena* and that all that is included in the description of the latter organism should be applied to the former.

Because this parasite is the cause of entamœbic dysentery and because of the widespread distribution of this disease, in sporadic form, throughout the United States, a knowledge of its morphology and life history is of interest and value to all practicing physicians in this country. Cases of the disease have been reported from almost every State in the Union, and I have, myself, observed cases originating in Minnesota, Illinois, Ohio, New York, Pennsylvania, Virginia, Louisiana, Florida, the District of Columbia, Mississippi, Arkansas, California and Texas.

Morphology and Life Cycle.

The morphology of *Entamœba histolytica* varies greatly at different stages in its life cycle, which may be divided into three distinct periods, i. e., the vegetative period of development, the pre-cystic period of development, and the cystic period of development. In each of these periods the morphology varies so much that unless one is acquainted with the changes that occur it might be thought that different species of entamœbæ were being observed.

Morphology in the Vegetative Period. Living Preparations.

In this stage of development two distinct types of nucleus occur, the so-called *histolytica* and *tetragena* types. The former occurs when the symptoms of dysentery in the host are most acute, while the latter is present when the symptoms are sub-acute or the disease is becoming chronic in type. The parasites vary in size from 25 to 80 microns in diameter, the majority measuring from 35 to 40 microns in diameter. The *shape* varies with the movements of the organism, being spherical or oval when at rest, and finger-shaped or irregular when motility is present. *Motility* is very pronounced in this parasite during the vegetative stage of development, the motion being progressive in type, a point of considerable value in distinguishing this species from *Entamæba coli*, in which motility is always sluggish and is less progressive in character. Motility is only well marked in the entamæbæ observed in freshly passed feces.

The *cytoplasm* appears reticulated and may contain one or more vacuoles, non-contractile in character. Two well-defined portions of the cytoplasm may be easily distinguished in the moving organisms and sometimes in the immotile ones; an outer hyaline portion, comprising about one-third of the organism, known as the *ectoplasm*, and an inner, reticulated portion, the *endoplasm*. The ectoplasm resembles ground-glass in appearance and refractiveness.

The endoplasm contains the *nucleus*, which may or may not be visible in the living organism. If the *histolytica* type of nucleus is present it is generally invisible, but if the *tetragena* type be present it is a prominent object within the endoplasm. In addition to the nucleus the endoplasm contains red blood cells, if blood be present in the feces, a very valuable distinguishing feature in differentiating this species from *Entamæba coli*, which practically never contains erythrocytes. The endoplasm may also contain yeast cells, crystals of various kinds absorbed from the feces, and bacteria, but these are very much less frequently present than in *Entamæba coli*.

When the *histolytica* type of nucleus is visible in the living specimen it consists of a very delicate ring of refractive mate-

rial enclosing a minute refractive dot, near the center of the nucleus, which represents the karyosome. When the *tetragena* type of nucleus is observed it presents a distinct, refractive nuclear membrane composed of granules of chromatin within which a more or less solid refractive karyosome may be observed, the entire nucleus appearing much more distinct than does the *histolytica* type of nucleus.

Stained Preparations.

In specimens wet-fixed and stained with iron-hemotoxylin the cytoplasm of *Entamæba histolytica* appears of a brownish or grayish color, granular and reticular in structure, and the distinction between the ectoplasm and the endoplasm is practically absent. The nucleus is always well defined and varies in structure from the typical *histolytica* variety, described by Schaudinn, to the *tetragena* variety, described by Viereck and Hartmann. The *histolytica* type occurs in the organisms observed when the symptoms of dysentery are most acute, and consists of a delicate nuclear membrane, not over a line in thickness, which stains almost black in color, enclosing a minute karyosome, generally represented merely by a deep black granule of chromatin. A centriole is not usually observed, but sometimes may be visible as a very minute, black granule within the less deeply stained karyosome.

Upon the inner side of the nuclear membrane very minute granules of chromatin may sometimes be observed, stained dark brown or black, and lying in the hyaloplasm, and between the nuclear membrane and the karyosome, a few small dots of chromatin may be found lying upon a very poorly defined linin network. The amount of nuclear chromatin present at this stage of development is much less than when the nucleus is of the *tetragena* type, and is very markedly less than is present in the nucleus of *Entamæba coli* during the corresponding stage of development.

The *tetragena* type of nucleus is present when the symptoms of dysentery become less marked, in cases recovering under treatment, and in relapses when the symptoms are not very

severe. For several years the vegetative forms of *Entamæba histolytica* presenting the *tetragena* type of nucleus were regarded as belonging to a distinct species known as *Entamæba tetragena*, and this well illustrates the importance of recognizing that two distinct types of nucleus occur in this species and that the occurrence of these types bears a constant relation to the clinical symptoms of entamæbic dysentery.

In stained preparations the *tetragena* type of nucleus presents a nuclear membrane of considerable thickness, when compared with the *histolytica* type, and large clumps of chromatin are not infrequently observed upon its inner surface. The chromatin may be collected at the center of the nucleus, forming a deeply stained, solid appearing karyosome, or, more frequently, it has a characteristic arrangement within the nucleus, either being scattered along the inner side of the nuclear membrane or as minute, deeply stained granules upon the dimly stained linin network, while the karyosome is comparatively large, irregular or roughly spherical in shape, surrounded by an unstained spherical interval, and containing a definite centriole, consisting of a dot of chromatin, which may also be surrounded by an unstained area.

Certain well-defined cyclical changes occur in the *tetragena* type of nucleus, which are quite characteristic. The karyosome sometimes appears as a fine network enclosing an unstained area within which lies the centriole, which may show division into two distinct granules; the outer border of the karyosome may be bounded by an unstained area of considerable extent, at the outer boundary of which the linin network commences, as a row of distinct dots of chromatin arranged in an irregularly circular manner. Again, the karyosome may stain almost uniformly throughout, the centriole appearing as a more deeply stained dot near the center, or the centriole may be invisible. The linin network also varies much in appearance, at times staining quite distinctly while at others it is almost unstainable. Lying upon the linin network there are generally numerous dots of chromatin, varying in their arrangement, while the inner surface of the nuclear membrane is often covered with minute dots of chromatin, or irregular, larger masses, quite similar to

those commonly occurring upon the nuclear membrane of *Entamæba coli*. These differences in the morphology of the *tetragena* type of nucleus are very characteristic of this stage in the development of *Entamæba histolytica*.

Organisms are sometimes observed containing two nuclei, generally both of the *histolytica* or *tetragena* type, but rarely one may be of the *histolytica* and one of the *tetragena* type, as shown in one of the photomicrographs. Careful search will generally show entamæbæ with nuclei intermediate in type between the classical *histolytica* and *tetragena* varieties.

In stained preparations, during the vegetative stage of development, many degenerating forms of *Entamæba histolytica* are encountered, especially when the acute symptoms of the infection begin to disappear, either spontaneously or as the result of treatment. These forms are characterized by the presence of chromidia within the cytoplasm, either in the form of rods, needle-shaped bodies, or irregular clumps, while the nucleus is often observed to be breaking up and liberating its chromatin to the cytoplasm. It is these forms that were mistaken for many years for sporulating parasites, or parasites undergoing reproduction by budding or gemmation. The fact that many of the largest masses of chromatin are frequently arranged about the periphery of the parasite or appear to be partially detached from the periphery with a small amount of cytoplasm, lead to this erroneous interpretation of these phenomena of degeneration.

Morphology of the Pre-cystic Stage of Development.

In the pre-cystic stage of development *Entamæba histolytica* multiplies by a primitive form of mitotic division and becomes markedly reduced in size. Organisms in this stage of development have been described by Elmassian⁷ as a new species, under the name *Entamæba minuta*, and there is little doubt that other authorities have also described new species from the pre-cystic stage of *Entamæba histolytica*.

In the *living* condition the size varies from 10 to 25 microns in diameter, the average being about 15 microns. The *shape*

is spherical or oval when at rest and irregular when the organism is in motion. *Motility* is much more sluggish than it is in the vegetative stage of development, but is generally more active than in *Entamæba coli*. The *cytoplasm* is divided into a well-defined ecto- and endoplasm, but this distinction can only be made in the motile parasites. The *nucleus* is almost always visible as a refractile ring of chromatin granules enclosing a few similar granules or a distinct karyosome.

In preparations *stained* in the manner mentioned the parasites present a nucleus intermediate in type between the *histolytica* and *tetragena* types present in the vegetative stage, the nuclear membrane being quite thick, while the karyosome is smaller and more compact than when the *tetragena* type of nucleus is present but larger than when the *histolytica* type is observed.

The linin network is generally obscured, but there may be considerable chromatin within the nuclear membrane, either upon its inner surface or scattered between the membrane and the karyosome. At this stage of development the nucleus of *Entamæba histolytica* approaches most closely to that of *Entamæba coli*, but the smaller size of the former should generally serve to distinguish it from *coli*.

Very frequently the cytoplasm of *histolytica*, at this stage of development, contains chromidia in the form of threads, granules, or clumps, and it is often difficult to be such whether such organisms are degenerative in character or whether the appearance of the chromidia is a normal process prior to cyst formation.

Morphology in the Cystic Period of Development.

Besides a primitive form of mitotic division of the nucleus, followed by the division of the parasite into two, which occurs in the vegetative, and, apparently, in the pre-cystic stage of development, *Entamæba histolytica* reproduces within a cyst, four daughter entamæbæ being thus developed. The cysts are only formed when conditions become unfavorable for the vegetative period of development, so that they are most frequently found in the formed stools after apparent recovery from an

attack of entamæbic dysentery, or in the semi-formed stools during the disappearance of symptoms of the infection. As the cysts are the active agents of infection their recognition is of the utmost importance in the prophylaxis of the disease.

In the *living* condition the cysts of *Entamæba histolytica* vary from 10 to 20 microns in diameter, and are surrounded by a cyst wall consisting of a delicate membrane, hyaline in appearance, and having a single outline in the younger cysts and a double outline in the older ones. The *cytoplasm* varies in appearance with the age of the cyst, appearing granular in the young cysts and more homogeneous when the cysts are fully developed. The cysts may contain a large vacuole in the early stages of nuclear division, while the cytoplasm generally contains brightly refractive, spindle-shaped, spherical, or irregular masses of chromatin or *chromidia*, which are practically distinctive of the species.

When fully developed the cysts of *Entamæba histolytica* contain four *nuclei*. In my experience this number is never exceeded, so that any specimen of feces containing only cysts with four nuclei or less may be safely considered as infected with this parasite. The nuclei appear as refractive, ringlike bodies within the cyst, and it is generally necessary to focus up and down in order to bring them all into view, as they lie at different levels in the cytoplasm. Any number of nuclei, up to and including four, may be observed in the cysts, but never more than the latter number.

In *stained* preparations the cysts present a cytoplasm stained a dull gray and finely granular in appearance. In this material are embedded the nuclei and the chromidial bodies already mentioned. The *nucleus* prior to division resembles in structure that found in the pre-cystic stage of development, having a rather thick nuclear membrane and a small, but distinct, karyosome. At this time the cyst may be without a vacuole, but often a very large vacuole is present, the nucleus being squeezed to one side of the cyst. After the division of the nucleus into two, the vacuole apparently disappears, for I have never observed a large vacuole in organisms having more than two nuclei.

The two nuclei produced by the primary division of the

nucleus have a very definite nuclear membrane and a well-defined karyosome, composed of a few minute granules or a solid mass of chromatin, stained almost black. These two nuclei again divide, the resulting four nuclei being much reduced in size, but each possesses a clearly defined, delicate nuclear membrane and a small karyosome composed of a granular mass of chromatin somewhat irregular in shape. The *chromidial* masses stain almost black and are very distinctive.

Degenerating cysts are frequently encountered, especially in the feces of patients who have received rectal injections of quinin. Such cysts contain numerous vacuoles and threads and clumps of chromatin, the nuclei being absent. These cysts have been mistaken for organisms undergoing reproduction by budding or gemmation, but there is now no question regarding their degenerative character.

The distinctive characteristics of the cyst of *Entamæba histolytica* are the presence of four nuclei, which number is never exceeded, and of the spindle-shaped, round, or irregular chromidial bodies within the cytoplasm.

Resistance to Physical Conditions and Chemical Agencies.

Comparatively little work has been accomplished upon the resistance of either the vegetative, pre-cystic, or cystic stages of development of *Entamæba histolytica* to physical or chemical agencies. It has long been known that exposure to the air at room temperature is followed by loss of motility in the vegetative and pre-cystic forms in a few hours, and likewise that either very hot or cold water will render the parasites motionless, but there is no data showing just how long such exposure is necessary in order to kill the organism during the various stages of development. A 1-100 solution of quinin sulphate will kill the vegetative forms within a few minutes, but the cysts resist such a solution for several hours. Weak solutions of several disinfectants, as permanganate of potassium, hydrogen dioxid, sulphate of copper, nitrate of silver, mercuric chlorid, argyrol, and dilute acids, will kill the vegetative forms after a few minutes exposure to one or two hours, according to the strength of the

solution, but the cysts are much more resistant and we have little or no data regarding the action of the drugs mentioned upon them.

Darling⁸ has determined that cysts in feces kept in moist chamber preparations proceed to reproduce as in the intestine, but that after six days most of the cysts have liberated young entamœbæ and have disappeared from the preparations. He found that he was unable to produce infection in cats with cysts that had been kept in the dried condition for a period of seven weeks, although Schaudinn⁹ produced infection in kittens with dried cysts six weeks old. Walker¹⁰ found that the vegetative forms were capable of resisting the gastric secretion of the human stomach, for he produced infection in three of four men who swallowed motile entamœbæ, but he concludes that in nature infection is almost entirely due to the cysts; he produced infection with cysts kept in a moist condition for a period of two and ten days respectively; the cysts also resist the human gastric juice, as every one of six men who ingested encysted *Entamœba histolytica* became parasitized. Kuene and Swellengreble¹¹ have determined that the cysts resist a 1-1000 sublimate solution for four hours; a 1-250 creolin solution for from five to ten minutes only; while fifty per cent. alcohol and boiling water kills them immediately. These authors found that drying killed the cysts within a few minutes; direct sunlight in a few hours, but that freezing for several hours killed very few. In water the cysts survived for three days when bacteria were numerous, but if bacteria were few in number the cysts survived for as long as four weeks. Emetin in a 1-100 solution killed the cysts in thirty minutes, but they resisted a 1-10,000 solution of this drug for twenty-four hours, although this solution killed the vegetative forms in thirty minutes.

Strong electrical currents kill both the vegetative and cystic forms of *Entamœba histolytica* and exposure to the Röntgen rays will kill the vegetative forms in fifteen minutes, but apparently has no effects upon the cysts. The use of the Röntgen rays in the treatment of entamœbic infection has not been followed by success and this is also true of the use of many of the drugs that will kill the entamœbæ in the feces. Unfortunately,

in entamœbic dysentery the entamœbæ that are causing most of the mischief are situated deep within the tissues of the intestine, where it is difficult, and generally impossible, for injections to reach them, and this undoubtedly explains the poor results that have followed the treatment of the disease by rectal injections alone. The more favorable results that have followed the hypodermic injection of emetin are explained by the fact that the drug, thus administered, reaches the entamœbæ through the blood stream even though they are within the tissues.

Recently salvarsan has been shown to be of remedial value in the treatment of entamœbic dysentery.

Relation to Disease.

The etiological relationship of *Entamæba histolytica* to entamœbic dysentery, and to the peculiar form of liver abscess which frequently complicates this disease, may be said to be absolutely proven by the results of recent experiments upon the lower animals and man. The experimental production of the disease in the lower animals dates back to the time of Loesch,¹² who produced dysentery in a dog by the rectal injection of fecal material containing entamœbæ, and his results were confirmed upon cats by Hlava,¹³ Kovacs,¹⁴ Kartulis,¹⁵ Strong and Musgrave,¹⁶ and others. Among all the contributions to the subject prior to Schaudinn's paper, there was none of greater importance than that of Harris,¹⁷ which contribution has been almost entirely overlooked by recent students of the subject. This investigator endeavored to produce dysentery in dogs by the rectal injection of various bacteria and of fecal material from dysenteric patients. Among the bacteria injected were the typhoid bacillus, colon bacilli, anthrax bacillus, the Shiga bacillus, pyogenic cocci, and mixed cultures of bacteria from dysentery feces. His experiments were carefully controlled and in not a single instance did the animals show any evidence of dysentery following the injections. On the other hand, the injection of fresh feces containing entamœbæ into the rectum of puppies was fol-

lowed in every case by a typical attack of dysentery resulting in the death of the animal experimented upon. In two of the animals entamæbic abscess of the liver developed, and in all of them the lesions were typical of those occurring in the disease in man. The period of incubation varied from three to six days, and sections of the intestines presented the microscopic pathology of entamæbic dysentery and the entamæbæ were demonstrated in the tissues.

The work of Harris was followed by that of several observers, all confirming the production of dysentery in susceptible animals by the rectal injection of material containing entamæbæ, but up to the time of Schaudinn's researches there was always great uncertainty as to the exact species of entamæba producing the lesions observed. His work cleared up this uncertainty by proving the existence of the pathogenic *Entamæba histolytica* and the harmless *Entamæba coli*. He was able to produce typical dysentery in kittens by feeding them material containing *Entamæba histolytica*, and in 1905 I¹⁸ was able to confirm his work by producing the disease in half-grown kittens by feeding them material containing this species of entamæba, as well as by rectal injections of the same material. Fifty per cent. of the animals given rectal injections developed the disease, while sixty-six per cent. of the feeding experiments were successful. The details of the anatomic findings at autopsy may be found in previous publications,^{19 20} but it suffices to say that the lesions were typical of those of entamæbic dysentery as observed in man, while one of the animals developed a typical entamæbic abscess of the liver, the entamæbæ being found in the contents of the abscess as well as in sections of the abscess wall. The period of incubation varied from six to fourteen days, being slightly shorter in the feeding experiments than after rectal injections.

In dysentery produced by the rectal injections the lesions were chiefly in the rectum, while after the feeding experiments the lesions were usually in the ascending colon, and of more severe character. The symptoms consisted of diarrhea, with the passage of blood-stained mucous stools, containing multitudes of motile *Entamæba histolytica*; rapid emaciation, with loss of

appetite and strength; and, finally, death from exhaustion. In some instances periods of improvement alternated with acute exacerbations, just as in the human disease.

All of the animals were carefully examined for entamæbæ prior to the experiments, in order to rule out a natural infection, and both pure and mixed cultures of the bacteria that could be cultivated from the dysenteric feces were fed and injected in other kittens to control the tests, and in none of the kittens so treated did symptoms of diarrhea or dysentery develop, and at autopsy no lesions were found in the intestine.

The entamæbæ observed in the feces of the infected animals and in scrapings from the lesions in the intestine showed the typical *histolytica* type of nucleus and numerous examples of supposed reproduction by budding or gemmation were noted, an observation since confirmed by the work of Darling,²¹ and now known to represent a degenerative change in the parasites.

These observations were soon confirmed by Werner,²² Hartmann,²³ and more recently still by Fantham,²⁴ Franchini,²⁵ and Wenyon,²⁶ and the etiologic relationship of *Entamæba histolytica* to a special form was considered proven so far as it is possible to prove such a relationship by experiments upon the lower animals.

In support of this relationship we had the following facts: (1) the absolutely characteristic pathology of entamæbic dysentery and the constant presence of *Entamæba histolytica* in the lesions and its absence from the lesions of other forms of dysentery; (2) the constant presence of this parasite in the tissues in the peculiar form of liver abscess so often complicating entamæbic dysentery; (3) the production of typical entamæbic dysentery and liver abscess in susceptible lower animals by feeding and inoculation experiments with material containing *Entamæba histolytica* and the demonstration of this parasite in the lesions so produced.

Although these facts were sufficient to convince most authorities that this parasite is the cause of the disease, there were no well-authenticated cases on record of an infection in man following the use of material containing *Entamæba histolytica*, if we except the instance of Schaudinn himself, who is said to

have become infected by swallowing material containing this parasite. It has remained for Walker and Sellards²⁸ to furnish the final proof of the pathogenic nature of *Entamæba histolytica* by producing the disease experimentally in man by feeding experiments in which the cysts of this parasite were used, and in their recent paper this series of experiments are given in detail, proving not only the pathogenic nature of *Entamæba histolytica*, but the harmless nature of *Entamæba coli* and of the cultural amœbæ once thought to be identical with the entamœbæ.

These investigators performed twenty feeding experiments upon as many individuals, using feces containing the cysts of *Entamæba histolytica*, and of these eighteen became parasitized, while of the eighteen, four, or 22.2 per cent, had developed typical entamœbic dysentery at the time of publication of their results. The incubation period of the dysentery in these four cases was twenty, ninety-five, eighty-seven and fifty-seven days, respectively, with an average of 64.8 days. The prolonged period of incubation is of great interest and practical importance, as it explains the occurrence of this type of dysentery weeks after the patient has left the endemic region. Walker properly makes a distinction between the period of incubation of the dysentery and the period elapsing after feeding before the entamœbæ could be demonstrated in the feces, i. e., before the subject became parasitized. In the latter case the period of incubation varies less, the entamœbæ sometimes appearing in the feces within forty-eight hours, the average period being nine days.

In my opinion, these experiments of Walker and Sellards furnish conclusive evidence of the causative relation of *Entamæba histolytica* to entamœbic dysentery and establish firmly the etiology of this disease.

Prophylaxis. All of the recent observation upon entamœbic dysentery and the parasite causing it prove that the cysts are the infective agents and that the prophylaxis of the disease rests upon the discovery of "carriers" of these cysts, their proper treatment, and the disinfection or proper disposal of their feces. It is beyond the province of this communication to treat of the

prophylaxis of entamæbic dysentery, but it is evident that such prophylaxis will only become effective when the practicing physician examines the feces of his patients with as much care as he does the blood or urine, for only by the microscopical examination of the feces can the "carriers" of this infection be discovered, as symptoms are generally entirely absent, or so slight as to be neglected when the cysts of *Entamæba histolytica* occur in the feces. A routine microscopical examination of the feces should be as much a part of a clinical examination as the use of the stethoscope, the clinical thermometer, or the examination of the blood or urine.

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Explanation of Photomicrographs.

Figure 1. Three examples of *Entamœba histolytica*. Vegetative forms. The central organism shows a typical *histolytica* type of nucleus. x 1300.

Fig. 2. Vegetative form of *E. histolytica*. Shows typical *histolytica* nucleus. x 1300.

Fig. 3. Vegetative form of *E. histolytica* undergoing simple division. The nucleus has just divided the two nuclei being of the *tetragena* type. x 1300.

Fig. 4. Vegetative form of *E. histolytica* undergoing simple division. The two nuclei have separated and are of a modified *tetragena* type. x 1300.

Fig. 5. Vegetative form of *E. histolytica* undergoing simple division, one of the new nuclei being of the *histolytica* type and one of the *tetragena* type. x 1300.

Fig. 6. Vegetative form of *E. histolytica* showing a modified *tetragena* type of nucleus. x 1300.

Fig. 7. Pre-cystic form of *E. histolytica* presenting nucleus similar in structure to that of *E. coli*. x 1300.

Fig. 8. Pre-cystic form of *E. histolytica*. Note small size. x 1200.

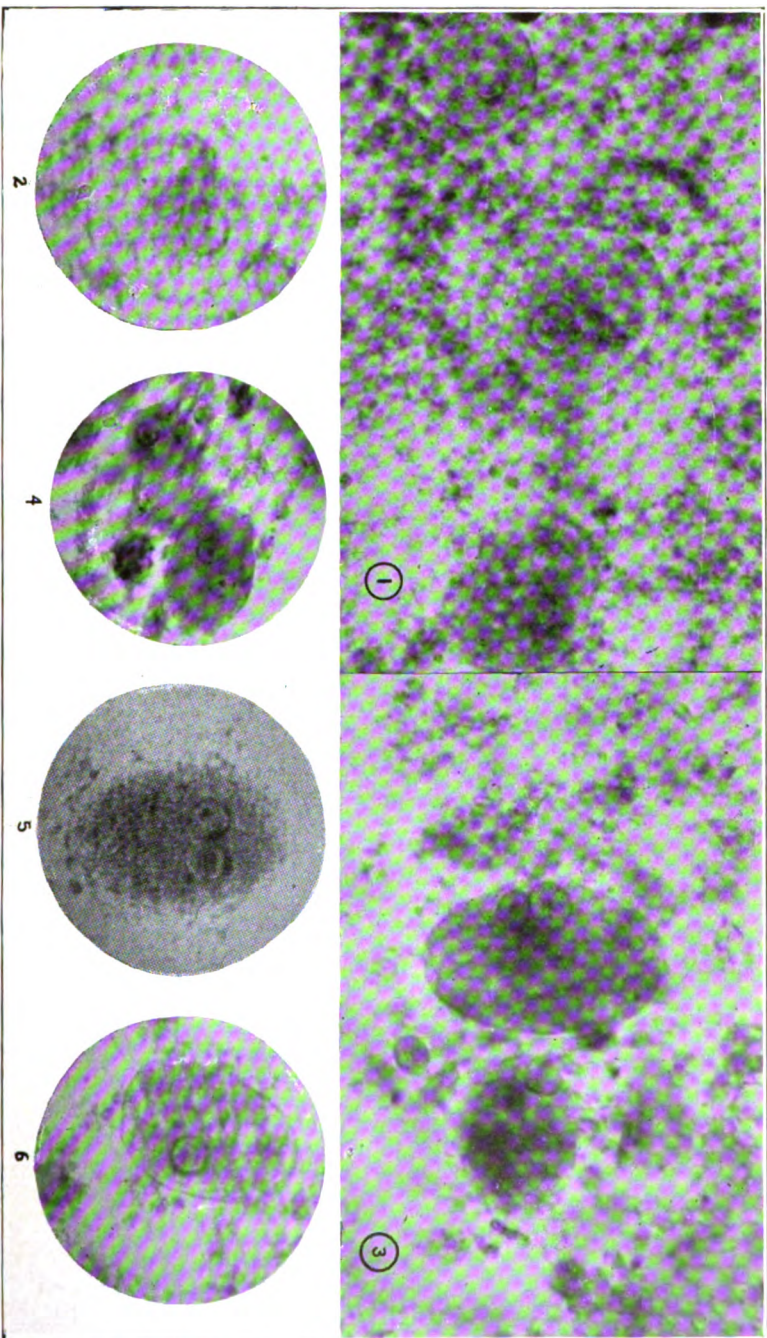
Fig. 9 Cystic form of *E. histolytica* containing one nucleus x 1150

Fig 10 Cystic form of *E. histolytica* containing two nuclei and large chromidal bodies. x 1150.

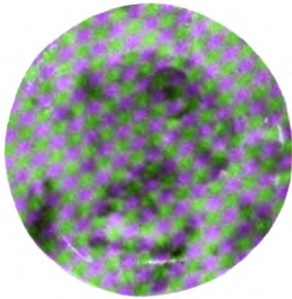
Fig. 11. Cystic form of *E. histolytica* containing three nuclei and large chromidal bodies. x 1150.

Fig. 12. Cystic form of *E. histolytica* containing four nuclei and a large chromidal body. x 1150.

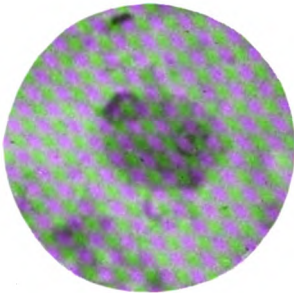
Fig. 13. Degenerated cystic form of *E. histolytica*, showing the distribution of chromatin in masses within the cytoplasm. This form has been misinterpreted as a "budding" form. x 1150.



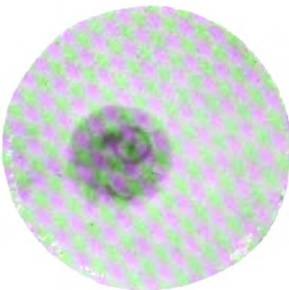
ILLUSTRATING PAPER OF DR. CRAIG
(See text for legend and definition)



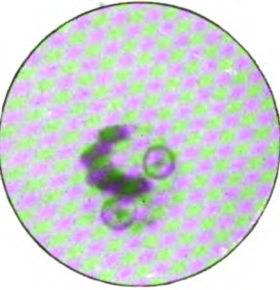
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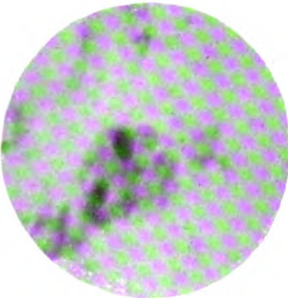
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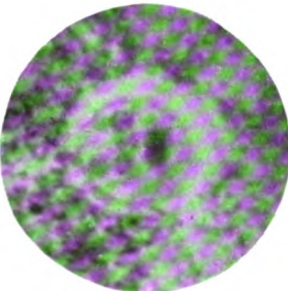
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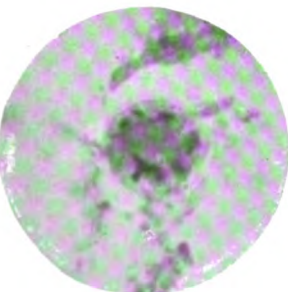
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ILLUSTRATING PAPER OF DR. CRAIG
(See text for legend and definition)

THE BEHAVIOR OF THE HANSEN BACILLUS IN VITRO.*

By

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The results obtained by those who claim to have cultivated the leprosy organism are apparently so much at variance that considerable doubt must in consequence exist regarding the specificity of any culture. While an analysis of the literature would convey the impression that so-called lepra cultures which have been isolated by different workers are biologically the same, a careful comparative study of those obtainable reveal the significant fact that hardly any two of them are identical. In other words, the cultivation experiments upon leprosy have yielded totally different results. Furthermore, many competent investigators have been unable to confirm the results of others though following with every care their indicated technic. Among these may be mentioned Frazer of the Confederate Malay States, who tested out thoroughly all media and methods advocated by various workers throughout the world and obtained uniformly negative results. It is true that Frazer did not consider the diphtheroids and streptothrices associated with the leprosy lesion of any etiological importance. Again, it is significant that those who believe they have succeeded in cultivating the Hansen bacillus have failed to recover the same culture consistently from a series of cases. Kedrowski in fifteen years' experience has only succeeded in isolating from two cases the culture which he to-day regards as *B. lepræ*. Bayon, of London, who cultivated an organism which he claims is identical with Kedrowski's, has been unable to recover it from a second case, though working with the material of a large leprosy settlement in South Africa. Clegg, in the Philippines, recovered what he thought to be the same organism from seven cases of leprosy; and the author, in Louisiana, has isolated a strain from four different cases which

*Read by title at the Eleventh Annual Meeting of the American Society of Tropical Medicine, Boston, May 29, 30, 1914.

he regarded at the time as identical with Clegg's. However, upon comparative cultural study of these Philippine and Louisiana cultures, it was found they represented four different varieties, if not as many species.

Thus we are confronted with serious discrepancies in the cultural results from leprous tissue experiments which undoubtedly account in part, as least, for the great diversity of opinion held to-day for the biology of the leprosy organism. Furthermore, it is an established fact that many well-known saprophytic acid-fast species behave experimentally and serologically in a manner that makes it impossible with our present methods to differentiate the latter from the so-called Hansen isolations.

Profiting by his own mistakes, the author, during the past two years, has attempted the cultivation of the same acid-fast organism from the uncontaminated leprous lesion in a large series of cases of widely different localities. Previous work had shown that by far the greater number of leprous lesions on the external surface of the body contain extraneous micro-organisms, and where these were of the ordinary well-known cocci or bacilli they were easily recognized culturally. On the other hand, in the cases showing diphtheroids and streptothrichal forms and acid-fast rods, the recognition of these as separate and distinct species, or the determination of any one or all of them as contaminants was often extremely difficult. So much so that in these cases the cultures were discarded. Only those in which the material removed remained sterile with respect to multiplication of bacterial forms not entirely acid-fast and not corresponding in morphology to the Hansen rods of the original lesion, were considered for cultivation purposes. In other words, cultures that showed on microscopic examination diphtheroids and streptothrichal types completely or partially acid-resisting were discarded. In all I have encountered five cases which I could with reasonable certainty regard as uncontaminated.

Based on the results in these cases, I would for the present conclude that the specific organism of Hansen *in vitro*, as *in vivo*, is distinctly acid-fast and a bacillus. The culture shows very little variation in size, shape and arrangement of the individual organisms from those in the leprous lesion. Their mul-

tiplication away from the host tissue occurs slowly and only in a spilt protein medium under aerobic conditions. At no time over a period of two years in which the bacilli have been under every possible cultural condition, have I noted the slightest difference in acid-fastness or in morphology other than minor ones which are common for any bacterial species. Streptothrical and diphtheroidal forms, partly or completely acid-fast, have never been noted for these cultures.

It is noteworthy that a great many workers are inclined to regard with significance the non-acid-fast and partially resisting diphtheroid organisms which they encounter in the leprosy lesion. Kedrowski in particular looks upon these as alterations or stages in the development of the Hansen species, even though his present day culture is definitely an acid-fast bacillus which cannot be altered into any of the original forms through which it is supposed to have transgressed while adapting itself to an artificial environment. On the other hand, Reinsteina, who believes, with Kedrowski, in stages for the leprosy organism, describes his culture as one which permanently loses its acid-resisting property and bacillary form when growing under artificial conditions. Both of these cultures I have studied and find them as different from each other as the *Streptococcus pyogenes* is different from the tubercle bacillus. One is a gram positive coccus occurring in chains, the other a gram positive and acid-resisting bacillus. Both are absolutely unalterable in these respects.

Though never regarding the so-called diphtheroids as playing any causal rôle in leprosy, I have considered it of importance to know in what pathological condition other than leprosy they may be found. At my suggestion, Drs. Lanford, Harris and Wade in our laboratories have undertaken this work. They have isolated them from such conditions as gummatoid lesions on the forearm in sporothricosis, skin lesions of pellagra, pulmonary tuberculosis, tubercular cervical adenitis, chronic acne, gonorrheal vaginitis, lymph nodes and spleen in lymphosarcoma, Hodgkin's disease, etc. I need only say here that it is remarkable how seldom they fail to find diphtheroids in all kinds of lesions, including those in which the causal agent has long been

established. In skin diseases they are commonly met with and occur most often in those of a chronic inflammatory nature. With respect to classification, these diphtheroids are gram positive and negative, non-acid-fast and partially acid-fast, chromogenic and non-chromogenic. Some are extremely hard to cultivate, others grow readily, while still others not at all. The wide distribution of the diphtheroids, occurring as they do in practically all superficial lesions of the body, make me view with skepticism the various stages described by some investigators for the Hansen bacillus. In my opinion, what is regarded as the non-acid-fast diphtheroidal stage for the Hansen bacillus represents in reality another species which plays no specific rôle in leprosy.

The author realizes that to describe the behavior of the Hansen organism *in vitro* one must first have established absolute proof of the identity of his culture. Thus far this has not been possible for any leprosy isolation because of the non-specificity of the experimental animal lesion and serum reactions for organisms of the acid-fast group. Without these important methods of differentiation we can only say tentatively that a particular culture from the leper is the true exciter of the disease. Permanent alterations in form and staining property, such as Kedrowski and others describe, could well be a mixture of several species. Therefore, I wish to emphasize that the isolation I now regard as the most likely cause of leprosy is based upon the fact that it is the only variety encountered in the uncontaminated lesion and whose individuals *in vitro* correspond in morphology and tinctorial reaction to the Hansen bacillus of the tissues. This culture, like all others, has not fulfilled satisfactorily the animal and serum tests which prove causal relationship to the disease.

Briefly it may be stated that the behavior of what I believe now to be the leprosy bacillus under artificial cultivation is as follows: The culture is distinctly acid-fast, resisting the decolorizing agent such as 30% nitric acid followed by 95% alcohol, or the Gabbett's solution, equally as well as the tubercle bacillus. Contrary to the general conception, *B. lepræ* is as difficult to decolorize when once stained as the tubercle. Dead bacilli are as much acid-fast as the viable. Even when indi-

vidual rods disintegrate into granular bits the latter are distinctly acid-fast. What Unna and others have regarded as dead lepra bacilli in the tissues are undoubtedly other bacteria.

In preparations treated to bring out this property of acid-fastness the individual leprosy bacilli vary from solidly staining short rods with tapering or swollen ends to irregularly beaded, slender and slightly curved bacilli. Quite common in culture are the short bi-polar forms with clear, unstained centers, and the solidly stained spindle-shaped variety which have enormously swollen central portions. It may be said that these two forms are characteristic and always present in culture and rarely if ever occur with other acid-fast species. On these odd forms the author has invariably been able to differentiate this organism of the uncontaminated leprous lesion from all others. The only difference noted for this lepra culture and the specific organism *in vivo* is that the former are somewhat thicker, longer, and show more variation in size and shape.

Multiplication of the acid-fast rods occurs in the removed leprous tissue under aerobic conditions and within a temperature range of 25° to 37° C. As a rule, there is not much difficulty in getting the bacilli to multiply in excised bits of tissue if the latter undergoes autolysis. However, in the digested tissue growth is extremely slow and does not appear to the naked eye before 8 to 10 weeks. Altho macroscopic colonies rarely develop, it is noted upon microscopic examination that the softened tissue has become literally seething in acid-fast rods. The growth in the tissues is moist and translucent and on removal readily forms a homogeneous turbidity when suspended in a liquid. The actively growing bacilli remain for a long time in dense colony masses which increase to great size. After the tissue matrix is destroyed the bacilli then spread away and eventually lose their microscopic colony features.

It is difficult to obtain growth from sub-plants of the original tissue culture. In the experience of the author this has only occurred where the artificial medium contained the split products of animal protein. Again here as in the removed tissue, multiplication is slow, taking weeks to become visible,

at which time it is only comparable to the growth of *B. influenzae*.

The morphology, staining reactions and growth *in vitro* of the culture above described are based upon a careful study of cultures recovered from four cases of the uncontaminated leprous nodule. While it cannot be said at present that this organism is leprosy, the constancy of its occurrence in the uncontaminated lesion and its striking analogy in morphology and staining reaction is at least presumptive evidence of its etiological relationship to leprosy.

STUDIES ON DIPHTHEROID ORGANISMS ISOLATED FROM LYMPHADENOMATOUS STRUCTURES OF THE BODY.*

By

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During the past three or four years so much has been written by men in various parts of the world on the finding of diphtheroid organisms in obscure pathological processes and an etiological rôle claimed for them by certain investigators, notably in leprosy and Hodgkin's disease, that the author undertook to determine their occurrence in various pathological lesions of the lymphadenomatous structures of the body.

With the publication by Frankel and Much¹ of the finding of non-acid-fast Gram positive bacilli in the sediments of anti-formin treated glands of twelve out of thirteen cases of Hodgkin's disease, the possibility of this disease being of an infectious origin became more likely. This probability was strengthened by the work of Negri and Meisemet², who successfully cultivated in two cases of Hodgkin's disease a diphtheroid organism which they termed *coryne-bacterium granulomatis*, *Hodgkinii*, and which they believe to be identical with the organisms described by Frankel and Much. Frankel and Much state that their isolations were non-acid-fast tubercle bacilli, possibly identical with ordinary tubercle bacilli, but more probably a special form of the tubercle virus, or at least belonging to a related group of organisms.

Shortly after the publication of Negri and Meisemet, Bunting and Yates³ reported the successful cultivation of an organism similar, if not identical, with that of the previous writers, from three cases of clinical and histological Hodgkin's disease, and observed them in two others. Furthermore, Billings and Rose-

*Read before the Eleventh Annual Meeting of the American Society of Tropical Medicine, Boston, May 29, 30, 1914.

now⁴ reported the finding of a Gram staining non-acid fast polymorphous diphtheroid bacillus in twelve cases of clinical Hodgkin's disease. Kusunoki⁵ found such bacilli in sixteen cases of Hodgkin's disease, while Steele⁶ obtained a similar organism from one case of this disease and one of lymphatic leukemia. Wolbach and Honeij⁷ in their studies upon leprosy lesions isolated a diphtheroid organism of extreme pleomorphism from the epitrochlear lymph node of a leper; while Gibbons⁸ reports the finding of a streptothrichal organism in the spleen of six cases of splenomegaly or Banti's disease.

With these facts in mind the author has, during the past several months, studied the bacterial flora of pathological lymphadenomatous tissues with a view to the cultivation of diphtheroids and the determination of their possible etiological significance. The cervical lymph nodes of two cases of clinical Hodgkin's disease, the spleen of one case of splenic anemia, the lymph nodes of two cases of glandular tuberculosis and the lymph nodes of one case of lympho-sarcoma constituted the material studied and form the basis of this report. In each instance an organism was recovered which presents the pleomorphic characteristics of the so-called diphtheroids.

The first case of Hodgkin's disease was in a young woman of nineteen years who had had the condition for several years, with gradual enlargement of all the glands of the body, the glands in the neck being particularly prominent. The piece of tissue was obtained under sterile conditions, and after being passed through the flame to kill all possible organisms that might have adhered to it from the skin or the hands of the surgeon it was placed in a sterile Petri dish. It was then teased into small bits, using instruments which had been thoroughly flamed. This finely divided material was then planted on coagulated human blood serum containing 1% of dextrose, the plugs paraffined and the cultures kept at a temperature of 37° Centigrade. In from three to ten days a few colonies were noted around the pieces of tissue in several of the tubes. Stained smear preparations from the colonies showed a Gram's staining organism of the diphtheroid type. Associated with the diphtheroid organism was a staphylococcus, probably the skin albus.

In order to make absolutely sure of a pure culture, since the pleomorphism of the diphtheroid organisms suggested at times a mixed growth, discrete colonies were repeatedly plated in dextrose agar, using every care to completely and thoroughly separate the individual bacilli. This was done by grinding up the growth of a single colony in a sterile mortar, with sterile sand, and making a suspension in dextrose bouillon, after which the suspension was passed through a sand percolator and plates prepared from the final percolate. The percolator was prepared by heating with a blast flame the lower fourth of a culture tube and drawing it out to a point having a diameter of from 2 to 3 millimeters; a small piece of cotton is placed in the lower part of the resulting cone-shaped end of the tube, and sand, chemically clean, poured into the tube to a depth of 5 to 8 centimeters; a cotton plug closed the upper opening; the whole was then sterilized with dry heat.

Culture was slow in growing at first, but later grew readily on ordinary solid media. At no time did the cultures grow well in bouillon except when planted on paper floats. Under this condition the growth spread over the surface of the broth without clouding the media, which indicates its preference for aerobic conditions. It is noteworthy that the culture of the first generation is of a light salmon color, becoming more chromogenic in subsequent plants, particularly on alkaline media, where it is from a light to a golden pink, depending on the age of the growth. There is no change noted in the various sugar serum waters.

At the time of isolation the organism is extremely pleomorphic, assuming various shapes and sizes from a cocco-bacillus 1 to 2 microns, to a large racquet-shaped bacillus 8 to 10 microns in length. The organism tends to retain this extreme pleomorphism, but in older cultures the predominating type is the small diplo-bacillus about the size of *B. hoffmanni*. The involution forms are particularly numerous in young cultures planted on Dorset's egg media. The organism is non-acid-fast, positive after Gram's method of staining, and takes the dye rather lighter than *B. diphtheriæ*. Individual bacilli present polar granules,

are barred, and still others are solid, with swollen ends. Occasionally there are relatively enormous oval forms.

The second case of Hodgkin's disease was in a male forty-four years of age, who had had the disease for several months, and was regarded clinically as in the acute stage of Hodgkin's. Tissue was planted, as in the first instance, and a pure culture of a diphtheroid organism was obtained, which, in all its characteristics, was identical with the first strain. The histological picture of the gland in both these cases corresponded completely to the Reed-Longcope type of Hodgkin's.

The case of splenic anemia studied was that of a young man, twenty-one years of age. The tissue was obtained immediately after the spleen was removed, and plants were made in the manner above described. A growth of pigment-producing organism was obtained in one tube, while in another tube a non-pigmenting growth resulted. Both of these strains were obtained in pure culture, direct from the human tissue. The chromogenic culture resembled in all of its characteristics the organisms obtained from the cases of Hodgkin's disease. The non-chromogenic differed from the chromogenic strain in that it is more vigorous in growth, the colonies being more moist and mucoid and becoming confluent more rapidly. This culture does not produce pigment on any medium, becoming only slightly dirty gray in old plants. It has a more persistent pleomorphism in older plants. Both strains fail to ferment any of the sugar serum waters. These cultures are non-acid-fast and retain the strain after Gram's method of treatment. The non-chromogenic variety resemble rather closely Bunting's X. F. A. strain, while the chromogenic simulates my cultures from Hodgkin's disease.

Tissue was planted on coagulated human blood under the same conditions as previously described, from two cases of tuberculous adenitis, and after ten to twelve days' incubation, a growth around the tissue in several tubes proved to be a diphtheroid organism in each instance. One of the cases showed a marked enlargement of all the cervical lymph nodes, and though a clinical diagnosis of Hodgkin's disease was made, the histological section showed a tuberculous process from which stained smears contained the tubercle bacilli. Subsequently a non-chro-

mogenic organism was recovered in pure form, resembling the non-chromogenic strain from the spleen and Bunting's X. F. A. cultures. The other tuberculous case was a negro male presenting clinical evidence of tuberculous adenitis with markedly enlarged glands on both sides of the neck. In one culture tube a light rose-colored growth developed which in stained preparation proved to be a diphtheroid, the predominating type being the small diplo-bacillus with granules at each extremity. In another tube, a faint growth was noted, which, when stained, resisted decolorization and proved later to be the tubercle bacillus.

Tissue was removed for cultural and histological examination from a male nineteen years old having a growth rapidly enlarging and extending on both sides of the neck, associated with enlarged lymph nodes over the body. Histological examination proved the condition to be a lymphosarcoma. Smears from a light yellow colony which appeared on the fifth day at the edge of one of the planted pieces of tissue showed a Gram positive non-acid-fast diphtheroid bacillus with marked pleomorphism.

The author has, therefore, succeeded in cultivating seven strains of diphtheroids from the spleen and lymph nodes of various pathological conditions. These cultures in general resemble each other in their morphology and staining properties. Five of them are chromogenic and two, at present, non-chromogenic. Four are similar and resemble in many ways Bunting's organism X. F. A. The last three strains are so recently isolated that the study of them has not been completed.

With a view to determining what causal relation these diphtheroid organisms bear to the person from whose tissues they were obtained agglutination tests were carried out on the sera from one of the cases of Hodgkin's disease and the case of splenic anemia, with the result that the Hodgkin's serum agglutinated the homologous organism and the chromogenic culture from the spleen. The serum from the splenic anemia case agglutinated the homologous chromogenic spleen culture markedly, however, only slightly the non-chromogenic culture from this case. It also agglutinated the strains from both cases of Hodgkin's disease. None of the sera agglutinated the Bunting strain.

These results indicate that there is some similarity in the antibodies produced by the several chromogenic organisms.

Guinea pigs have been inoculated into the axillary space with heavy suspensions of the two spleen strains, the two Hodgkin's organisms and Bunting's culture, and the resulting inflammatory mass removed in one, two and three weeks. This mass is the adipose tissue of the part which has been almost entirely replaced by acute, subacute and chronic inflammatory tissue. Here and there microscopic areas of necrosis are noted, but in no instance is the suppuration extensive. Endothelial cells (both single and multinucleated) are very numerous, particularly in the older lesions. The lesion occasioned has always been in the surrounding adipose tissue of the axilla. In no case has any change been produced in the axillary lymph structures. The same organisms were recovered from the lesions after two weeks' sojourn in the body. Guinea pigs, rabbits and white rats are at present under observation, which have been inoculated subcutaneously and intraperitoneally at various intervals.

The presence of diphtheroid organisms, as shown by cultures in so many pathological processes, naturally causes one to consider just what relation, if any, they bear to the disease itself. Are they the etiological factor in the production of various obscure and vague clinical pictures, such as Hodgkin's disease, splenic anemia, leukemia, leprosy, etc., or do their presence in these tissues prepare the soil for other organisms or indicate a lowering of the natural resistance of the body, permitting their multiplication? Certainly in the lesions of known etiology like syphilis and tuberculosis, they can have no causal significance. While in those lesions of obscure etiology they may be considered, until proven otherwise, of possible causal importance, too much should not be attributed to them, in view of the fact that they are of such wide spread distribution, and are found so often in well understood pathological conditions. In this connection the work of Robertson⁹ is significant who, long before the discovery by Noguchi¹⁰ of *Treponema pallida*, in the brain tissue of dementia paralytica, isolated a diphtheroid organism from the lesion, which he regarded as playing a causal rôle. It is interesting to note in this connection the opinion of Ke-

drowski¹¹ and others who regard the diphtheroid types encountered in the leprous lesions as alterations or stages in the developmental cycle of the Hansen species. In view of my work with diphtheroids I am inclined, like Duval,¹² to regard these forms as separate species and not stages traversed by the leprosy bacillus, while adapting itself to an artificial environment.

Bunting¹³ believes that the diphtheroid he has isolated in several cases of Hodgkin's disease is the etiological factor, since by repeated inoculations of one of his strains into the axillary region of the monkey he has produced, after three months, a progressive enlargement of the adjacent lymph nodes which histologically present the same picture as human Hodgkin's disease of the same duration. Billings and Rosenow¹⁴ believe that they caused an improvement in some of their cases of Hodgkin's disease by the use of autogenous vaccins, but they admit having used also the Röntgen rays and state that all their cases were not histologically Hodgkin's disease.

Kedrowski¹⁵ and others have isolated from leprosy a diphtheroid which they believe is the etiology of leprosy and claimed they were able to produce experimentally tissue changes similar, if not identical, with human leprous lesions.

The fact that the diphtheroids have been found in the lesions of dementia precox and dementia paralytica, splenic anemia, leprosy, Hodgkin's disease, leukemia, acne, sporothricosis and various suppurative processes, and their location in pathological lesions which we believe they did not produce, indicates a universal distribution throughout the entire body.

No attempt has yet been made except that of L. Hoag¹⁶ to classify this ubiquitous group of organisms, but that they vary greatly in their biological characteristics is evident from the fact that the ones which have been described by various workers may be either Gram negative or positive, chromogenic, and non-chromogenic, acid-fast and non-acid-fast. Hoag, in a study of 166 diphtheroid organisms obtained from various pathological processes and from normal organs at autopsy, which he was able to differentiate from the well-known types of the pseudo-diphtheria group, classified them into one large group which he called organism X. As we study the bacteriology of tissues

more closely and carefully we will possibly find that these diphtheroid organisms are of quite general distribution and a causal rôle may be proven for some of them.

The result of my animal experiments with the diphtheroids isolated from Hodgkin's disease and splenic anemia are not sufficient to cause me to form an opinion as to the rôle they play in the production of these diseases. However, it must be borne in mind that a lesion of a chronic inflammatory or proliferative nature follows the introduction into the body of a great variety of well-known saprophytes and therefore, too, much dependence must not be placed on experimental lesions aloné and we should be very careful to attach any etiological relationship for a group, or members of a group, of organisms which are so ubiquitous.

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Discussion.

DR. WESTON P. CHAMBERLAIN, Plattsburgh Barracks. In fowls, which have been employed in beri-beri experiments, a number of cases of avian diphtheria were found. The diphtheroid organisms were cultivated from the membrane but could not be inoculated into other fowls.

DR. E. E. TYZZER, Boston, Mass.: I have made some studies on the inoculation of gland material from cases of Hodgkin's disease. Excised glands have been planted in guinea pigs and monkeys and ground up glands have been inoculated in the axilla of some animals. In no case was Hodgkin's disease reproduced.

DR. RICHARD P. STRONG, Boston, Mass.: The statements made in Dr. Lanford's paper are of particular interest on account of the similarity of these organisms to the various organisms cultivated from leprosy lesions. The relation that these organisms bear to disease in man and the relation that various organisms obtained from leprosy lesions is somewhat parallel.

DR. JOHN A. LANFORD, New Orleans, La.: I recently obtained a culture of *B. terosia* from a pseudo-membranous cystitis. The organism is non-pathogenic for guinea pigs. I do not at present consider the organisms I isolated from the lymphadenomatous structures of man to bear an etiological relation to the diseased tissue from which they were obtained.

AN EPIDEMIC OF MALARIA AT GREENWICH, CONN.*

By

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During the year 1912, Greenwich, Connecticut, achieved a large notoriety by the prevalence of malaria in its midst and by the widespread publication of distorted reports of the extent of the disease. It was really not the mere presence of malaria which made such attractive newspaper copy, but rather, that Greenwich, the home of fifty or more millionaires, and reputed to be the richest town of its size in the country, was tolerating the existence of any disease well known to be preventable. The statement was made in the New York papers that there had been nine hundred cases during the year, and that nothing was being done to stamp out the disease.

Your President has asked me to give you the history of malaria in Greenwich .

Description of the Town.

Greenwich lies on Long Island Sound, about twenty-eight miles east of New York City. Its western limit forms part of the interstate line between New York and Connecticut. The town is eight miles long and six miles wide. The surface is rolling, consisting of north and south ridges and depressions, rocky and well wooded. There are numerous brooks and small rivers running to Long Island Sound. The irregular surface and the rocky formation have combined to make numerous swamps. Along the shore there are many areas of salt marsh. A survey made in 1913 showed approximately eighty swamps needing drainage.

Along the water front there are several closely built up villages. The most important of these is the Boro of Greenwich, with a population of four thousand. The total population of

*Read at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held in Boston, May 29, 30, 1914.

the town is now stated to be eighteen thousand. The town is essentially a residence suburb of New York City. The poor people are largely emigrants, Poles, Italians, Russians, etc., living in quarters and under conditions little better than the worst city slum. We speak of the Italian settlement at Mianus, the Polish at Glenville, and so on. Throughout the town there are these small communities of the various nationalities. In the Boro of Greenwich we have a mixture of them all.

The climate is temperate. Extreme high and low temperatures are of short duration, with a maximum of 100 degrees and a minimum of 10 degrees below zero.

The Boro of Greenwich has adequate sewers. Up to this year the waste disposal in the rest of the town has been by cess-pools and privies. A recently established sewer commission has divided the town into sewer districts and construction begun in the worst areas. The sewage flows into Long Island Sound and causes grave pollution. The sewer commission contemplates the erection of disposal plants at the sewer outlets.

The water supply, while inadequate in the past, has been potable and to date has caused no appreciable disease. It is collected into storage reservoirs and runs by gravity to the consumer. The filtration is mechanical. Many private wells are in use, particularly on the estates at the higher levels.

The report of the health officer for 1913 shows a death rate of fourteen per thousand. During the past five years the mortality from malaria was four-tenths of one per cent, i. e., five deaths in five years. The following communicable diseases were reported during 1913:

Measles	95
Scarlet Fever.....	16
Cerebro-spinal Meningitis.....	1
Diphtheria	8
Whooping Cough.....	27*
Typhoid Fever.....	8
Pulmonary Tuberculosis.....	9*
Infantile Paralysis.....	2

*Many cases not reported.

Thus, in spite of numerous unhygienic conditions, the health of the town is good, and compares favorably with adjacent communities.

Existence of Malaria in the Past.

Malaria has long been endemic in New Jersey, New York, Connecticut and Rhode Island. The literature makes frequent reference to the disease in these States prior to 1900, and since then, many references to campaigns to eliminate the mosquito. The work in New Jersey and on Staten Island is familiar to you. In Connecticut, in 1904, Dr. Britton, state entomologist, pointed out the requirements in control. His advice, however, received scant attention until recently when malaria became epidemic.

I wrote to prominent physicians in Port Chester and Rye on the New York side, and in Stamford, Bridgeport and New Haven in Connecticut. Replies from these men show that malaria is endemic throughout this section. Malaria conditions in Greenwich are, then, similar to and a part of those of the sea front states in this latitude. The oldest practitioners in town relate that they saw cases of malaria very early in their experience. Such evidence is questionable, but the description seems to correspond to the disease. I remember hearing a homeopathic physician, now deceased, describe his early struggles with a case which he finally conquered by massive doses of quinin. Thirteen years ago my first maternity case in Greenwich gave me a well-remembered fright. The chills and fever were, however, explained when I found her blood loaded with a double infection of the tertian parasite. From that time I saw an occasional case, usually from the same locality, until during the last five years the number of cases seen gradually increased until malaria became one of the common problems encountered in general practice. The maximum was reached in 1912. In 1913 the number decreased as the various measures for control became effective.

Conditions in Greenwich Favoring the Perpetuation of Malaria.

Throughout the town there were found many swamps, ponds, brooks and rivers in which anopheles (*maculipennis*) were breeding. All other mosquitoes were *Culicidæ*. In the Boro particularly there were many guilty catch basins, tin cans, and the like. In many of the estates the waters of brooks and springs have been impounded to form lakes and ponds. The natural vegetation is luxuriant. There is profuse ornamentation by shrubs and vines. The owner of one large estate complained that all of his employees had had malaria. During the investigation it was found that his series of artificial ponds were breeding mosquitoes in large numbers.

The poorer houses are unscreened, or at best very inadequately. Among the well-to-do good screening is the rule, and there are many well-screened sleeping porches.

Investigation has abundantly proved the existence of chronic malaria carriers. I have already seen, this spring, several return cases who have not been conscientious in the regular use of quinin. Verbal reports from the health officer and other physicians, this month, indicate a similar experience, but thus far we have seen no cases of primary infection. In January of this year, I discovered a marked infection in a two-weeks-old infant, the child of a mother who had had malaria during the preceding summer, and who stated that she had taken quinin continuously during the winter. Careful search of the house revealed no mosquitoes. It is not unlikely that the infection was intra-uterine.

Thus, the conditions have been perfect for the dissemination of the disease. Deficient health regulation, increased population, modification of the physical character of the land, and ignorance and carelessness in treating acute and chronic cases have combined to make the disease very prevalent in recent years. The height of the epidemic was reached in the spring and summer of 1912. One physician made inquiries among the local practitioners and this canvass was the basis for his statement, later, that there had been nine hundred cases in the year, this report being the origin of the newspaper accounts, and one of the causes



ILLUSTRATING DR. GESSNER'S REPORT OF CASE OF AINHUM

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of the apprehension among the inhabitants which led to actual corrective work in 1913. This canvass was verbal, among the physicians, and was undoubtedly incorrect in its conclusion. The diagnosis by blood examination was the exception. For example, the canvasser referred an obstinate case of "malaria" to the hospital. She was discovered to be suffering from pyelitis.

Remedial Measures.

During the summer of 1913, by coöperation between the health officer, the medical society, various charitable organizations and individuals, a fund of twenty-five thousand dollars was subscribed by the town and individuals. This fund was expended by the health officer and an advisory committee. The methods employed during the early months consisted of periodic oiling of all ponds and swamps in the malaria areas, inspection and removal of gross nuisances in the Boro and other congested districts, incidentally destroying tin can breeding and the like. Bulletins were sent to all householders and a house-to-house educational campaign started, during which the inspectors were able to find four hundred persons who stated that they had had malaria during the preceding year. In April, 1913, the physicians in the town were requested to report all cases of malaria occurring in their practice. During the summer about two hundred cases were thus reported, of which sixty, only, were given as primary infection. In July, 1913, a contract was awarded to a well-known drainage and irrigation company, who agreed, for a sum of \$15,500.00, to rid the town of all natural mosquito breeding. Drainage by open ditches was the method employed. The salt marsh work by special machines appears to be satisfactory, but with rapidly refilling ditches and rocky barriers the results inland seem, at the present time, inadequate. It is clear that the ditches will require constant attention with additional oiling to insure immunity from breeding. With our neighbors we must eventually secure proper drainage by the loose tile method.

To recapitulate.—1. Malaria of the benign type has been endemic in Greenwich and vicinity for many years.

2. The number of cases gradually increased until during 1912 and 1913 the proportions of an epidemic were reached. As shown, the physical and hygienic conditions were extremely favorable to this development.

3. Corrective measures have lessened the spread of the disease. The organization of a better health department, with proper inspection and cleaning of congested areas, with temporary expedients such as oiling, have apparently stopped the progress of the disease, but it is obvious that no permanent results can be expected until efficient drainage can be accomplished. The open ditches, while unsatisfactory, will, however, help enormously if properly maintained. This we are endeavoring to do by making a new contract for maintenance with the company which did the original work. The public and private purses have been generously opened and when large expenditure can be made for permanent drainage, and enforcement of health regulations, we confidently expect to be rid of this stigma.

I am indebted to Dr. Schereschewsky of the Public Health Service for much of the above data. He made an investigation of health conditions in Greenwich, in August, 1913, and his report may be found in the reports of his department.

Discussion.

DR. RICHARD P. STRONG, Boston, Mass.: I have been much interested in the remarks made by Dr. Bass concerning the existence of agglutinins in the blood of malarial patients. Why does not *pirax* produce an agglutinin? Malaria is fairly common in New England.

DR. WESTON P. CHAMBERLAIN, Plattsburgh Barracks, N. Y.: In 1898, I saw a case of malaria at Old Point Comfort in the person of a young woman, who said that quinin produced a very troublesome urticaria with swelling of the throat and a tendency to suffocation. Quinin was given, however, and the symptoms described by the patient occurred. The patient was then given $\frac{1}{2}$ grain of quinin in solution every hour. After the second dose urticaria appeared; but the treatment was persisted in and soon the patient could take as large a dose of quinin as anyone.

DR. GEORGE C. SHATTUCK, Boston, Mass.: In and about Boston malaria is less common at present than it was some years ago. In 1905 several cases were seen each week during the summer at the clinics of the Massachusetts General Hospital. Now, there is almost no malaria seen in these clinics.

MR. FRANK G. HAUGHWORT, New York City: Could it be possible that a transient glycemia might cause relapse in cases of malaria?

DR. WESTON P. CHAMBERLAIN, Plattsburgh Barracks, N. Y.: In 1893 there was considerable malaria in Boston; but from 1870 to 1885 it was hardly known in the Charles River Valley.

DR. M. VICTOR SAFFORD, Boston, Mass.: What is the frequency of the susceptibility to quinin? On one occasion I gave five grains to an adult Italian. After the administration the patient had a temperature of 104°, rash and marked dyspnea. The symptoms persisted for 24 hours.

DR. C. C. BASS, New Orleans, La.: The explanation of the failure to find agglutinin in benign malaria is possibly because the work has not been sufficiently extensive. It is quite possible to have a quick macroscopic agglutination test for *falciparum*.

Quinin intoxication does occasionally occur; but the cases are extremely rare.

Concerning the influence of glycemia on malarial parasites: On one occasion I saw a diabetic patient with malaria and succeeded in cultivating the parasites without adding dextrose to the culture medium. A physician from a Mexican mine recently said that patients with arsenical poisoning had been observed with malarial parasites in their blood; so that arsenic in this form had no influence on the growth of malarial parasites.

REPORT OF AN UNUSUAL AMŒBIC INFECTION OF THE GENITO-URINARY TRACT.

By

W. J. LYNN, M. D.,

Superintendent Limon Hospital, Costa Rica Division, United Fruit Company.

H. V., No. 19,674, is an intelligent colored man, having been employed in the medical department in the capacity of a dispenser for the last two and one-half years; had the general diseases of childhood, and has enjoyed good health, more or less, up to the present time. About two years ago, he had a Neisserian infection, which, according to him, was properly treated, and he has had no recurrence since then. Denies any lues. Habits are moderate and leads a rather quiet life. He came to the hospital complaining of urinary incontinence and a burning sensation on urinating. He intimates that some weeks ago he felt a pain in the trigonum vesicæ at the end of micturition. Thinking that he was suffering from a congested prostate, he took a rectal lavage, using a solution of antipyrin, which apparently gave him some relief. Not satisfied with results of this treatment, he thought it best to take a bladder lavage, using same solution, also the same syringe. Some four or five days later, he experienced a much more aggravated return of his symptoms and also noticed some blood and pus in the urine. This caused him considerable worry, and brought him to the hospital at

once. A small sound was passed on him with some difficulty, meeting with a stricture close to the neck of the bladder or prostatic urethra, but this feature could not, of itself, account for his complaint.

The urinalysis report showed blood, pus, and motile amœbæ (*Entamœba tetragena*.)

On being questioned, he acknowledged that he had neglected to sterilize the syringe after having taken his rectal lavage.

The microscopic findings of the stool were negative for amœbæ, although some pus and blood were found. The stool examination was not made until after two doses of emetine had been given hypodermically, which may account for not being able to find amœbæ in the stool.

The patient responded very well to treatment and in the course of five days the vesicle tenesmus was relieved and the urine cleared. He has been kept under observation for the last month, and has had no return of his symptoms. A very careful examination failed to reveal any connection between the intestinal tract and the bladder.

CASE OF BILATERAL AINHUM.

By

H. B. GESSNER, M. D.,

Professor of Clinical Surgery, Tulane University of Louisiana, New Orleans, La.

Case.—Arthur Turner, negro plantation laborer, 60 years of age, from Lone Star plantation in the Parish of St. Charles, La. seen at Charity Hospital, New Orleans, for an intercurrent affection, in the autumn of 1913.

The "spontaneous amputation" took place in 1907; both sides were affected at the same time. Patient was working in river sand at the time, building a house.

According to his account the process took one month; there was no bad smell, no pain. He had never been out of Louisiana.

Photographs submitted as a matter of record.

NEWS AND COMMENT

Major Thomas L. Rhodes, M. C., U. S. A., has been appointed superintendent of the Colon Hospital, Canal Zone.

A campaign has been started in East Liverpool, Ohio, to forbid loitering and spitting on the sidewalks.

Up to January 1, 1914, 45,470 cases of hookworm disease were reported to have been treated by physicians in Kentucky.

Dr. George M. Malkin, formerly of New Orleans, is now stationed at the United States Navy Recruiting Station, Des Moines, Iowa.

The Wellcome Bureau of Scientific Research has moved from 54a Wigmore and is now at 10 Henrietta Street, Cavendish Square, London W.

Surgeon James C. Perry, U. S. P. H. S., has resigned as chief quarantine officer of the Canal Zone and has been granted a year's leave of absence.

October 2 will be set aside throughout Indiana and will be known as disease prevention day. Tuberculosis will receive special attention, and many societies, associations and boards will be represented.

A telegram has been received by Commissioner S. S. Goldwater of New York, asking that 50 liters of tetanus serum be sent at once to Vienna. The Otisville laboratories will furnish the serum.

Among the members of the American Society of Tropical Medicine who are abroad and unable to return to the United States are Dr. Macimilian Herzog, Chicago, and Dr. James M. Anders, Philadelphia.

Many towns and villages in Ohio have started to destroy rats. As the estimated damage done by rats in Ohio is over \$10,000,000, the State will not only have protected itself against disease, but will have benefited economically.

Eleven thousand four hundred dollars has been asked for by Dr. Clyde E. Ford, commissioner of public health of Ohio, with which to establish a bureau of child hygiene. He has also asked for an increase of \$23,000 in the annual appropriation.

The Medical Journal of Australia has been organized and with it have been incorporated the Australasian Medical Gazette and the Australasian Medical Journal. The new journal will be the official medium of the Australasian branches of the British Medical Association.

The Albany Medical College has announced a special course in hygiene and preventive medicine. The State Board of Health will coöperate. Among the lecturers announced are Drs. C. E. A. Winslow, Hermann M. Biggs, Linsly R. Williams, Augustus B. Wadsworth and Cressy L. Wilbur.

The laboratory of the Ohio State Board of Health will move into one of the buildings on the campus of the Ohio State University. This is in accordance with the plan of the secretary of the Board to unite more closely the various State departments and the State University.

On May 17, a man living at Walnut Creek, California, became ill, and his case was diagnosed a mild case of bubonic plague. He soon recovered. The case was believed to be gotten from ground squirrels, as the patient had been cutting hay and within two weeks of his illness had shot and skinned squirrels.

Dr. Mazyck P. Ravenel, formerly professor of bacteriology at the University of Wisconsin and director of the Hygienic Laboratory, has been appointed a member of the advisory board of the hygienic laboratory of the U. S. Public Health Service,

Washington, D. C. Dr. Ravenel will become professor of preventive medicine and bacteriology at the University of Missouri this year.

A fund is being raised to erect a monument in memory of Daniel A. Carrion, who in 1885 inoculated himself with blood from a verruga tumor. He was a student in Lima, Peru, at the time, and hoped to make some progress in the nature of the disease, but died from it in two months. The fund for the memorial is in charge of Professor E. Odriozola, dean of the medical faculty, Lima, Peru.

The week of November 15-21, 1914, has been set aside as Health Week in London by the Health Week Committee, of which the Lord Mayor of London is chairman. It is not necessary in England to have clean-up campaigns as in this country, as unsightly nuisances are not tolerated, so attention may be turned directly to health. Unless the present war situation interferes with the carrying out of the plans, Health Week will be observed throughout England and the Colonies.

In the August 22 number of the *Journal of the American Medical Association*, J. A. Ferrell, Washington, D. C., tells of the growing need of public health workers. In almost every state, city and town, health officers are employed, and gradually it is being realized that these men must be specially and adequately trained for the important posts they hold. As the demand increases, compensation does likewise, and the field of public health work has now grown into a large and attractive one.

The American Posture League has issued an interesting and instructive little pamphlet giving some of the purposes and plans of the society. Many diseases and deformities may be traced directly to incorrect standing or sitting positions, to clothes which restrict breathing and free movements, and especially to chairs, seats and work benches that do not support the body properly. All of these things the American Posture League will try to correct. One street car company has already consulted

the League about the construction of a new car they are to build, and interest is being shown in many other directions, particularly for shop girls and motormen. Bulletins and illustrated charts covering factory, shop, school and other conditions will be issued, and lantern slides and lecture outlines will be supplied. The secretary of the League is Dr. Henry L. Taylor, New York Post-graduate Medical School, and the president is Jessie H. Bancroft, Assistant Director of Physical Training, Public Schools, New York City.

An announcement, which we print in part, has come to us of a new South American journal. Prof. Charles E. Porter, occupying the chair of general zoology and applied entomology and also director of the recently established Museum and Laboratory of Economic Zoology at the National Agricultural Institute of Santiago, Chili, has undertaken the publication of a new scientific journal under the title *Anales de Zoologia Aplicada*. This journal is to be especially devoted to original studies on species beneficial to and parasitic on men, domesticated animals and cultivated plants in America. The well-known *Revista Chilena de Historia Natural*, edited by Prof. Porter, is being continued, but only for systematic papers. The *Anales de Zoologia Aplicada* will accept original contributions on American parasites (Protozoa, Vermes, Arthropoda), which may be in English, French or Spanish." Prof. Porter is well known in the field of entomology and zoology, as well as for his work on the *Revista Chilena de Historia Natural*, and we wish his new journal every success.

Public Health Activity.

CALIFORNIA—Monthly Bulletin of the Los Angeles Health Society, June, 1914. There are many homes in Los Angeles caring for young children and over these a strict supervision is held. Those holding licenses must comply with the instructions that have been compiled for their use. An attempt is made to inspect each house once a month, oftener if there is any suspicion of neglect. There are eighty-four boarding houses for children and eighteen day nurseries in Los Angeles, yet not a

home where a working mother may stay with her child. In Rome, in large buildings or tenements, there is a Montessori school, where the children may be cared for during the day at a nominal cost, and it is found that there is a gain of 7 per cent. on the money invested.

FLORIDA.—*Health Notes*, July, 1914. Dr. R. H. Von Ezdorf, U. S. P. H. S., made a survey of the malarial conditions in Florida and a few of the interesting figures are as follows: There were 958 cards mailed and 120 reply cards received. Four hundred and forty-five cases were treated and the prevailing type of infection was tertian, the next being tertian and estivo-autumnal. Of the cases reported, 119, or 26.74 per cent., were in children under 15 years of age.

NORTH CAROLINA.—*The Health Bulletin*, July, 1914. The North Carolina Medical Society, on June 18, 1914, adopted the following resolutions, which are worthy of note and high commendation:

Be It Resolved, That the Medical Society of the State of North Carolina will use its best efforts to discourage the use of alcohol in any form as a beverage.

Resolved, Second, That it is the sense of this Society that any member of the profession who does promiscuous or unnecessary prescribing of whiskey, either to patients or non-patients, is violating one of the principles of our profession, and is deserving of censure.

Resolved, Third, That alcohol as a drug can be eliminated from the pharmacopoeia, without in any degree crippling the efficiency of the doctor's armamentarium.

NORTH CAROLINA.—*The Health Bulletin*, August, 1914. The State Board of Health of North Carolina is to conduct a prize contest for essays on typhoid fever, malaria, diphtheria, scarlet fever, whooping cough and measles. The contest is open to any citizen of North Carolina and \$25 each will be given those whose papers are decided to be most likely to interest and instruct the people of the State. Requests for pamphlets on these subjects

are constantly being received by the Board and the essays awarded the prizes will be used as standards and will be sent out whenever a request for material on these subjects is made.

OHIO.—Weekly Report of the Board of Health of Cincinnati, August 29, 1914. A plea is made to establish a hospital-school for handicapped children in the grounds of the Cincinnati Hospital. Children would be kept at the hospital-school under medical attention and at the same time would receive a school education and industrial training. By staying at the school for a number of years and by receiving instruction appropriate to their physical and mental condition, they could become self-supporting instead of being a burden to their families and the State as well as to themselves.

OREGON.—Quarterly Bulletin of the State Board of Health, April, May, June, 1914. Under the title, "The Pollution of Streams," the view is taken that courts give little assistance in preventing this deplorable condition. The Supreme Court recently rendered a decision which nullified much of the work that had been done in the State. They held that "only the person injured could bring action against an individual or community for polluting a stream, that an anticipated danger was not a real one." Apparently the Supreme Court does not recognize preventive medicine, which would prevent rather than cure.

A CORRECTION.

*The American Journal of Tropical Diseases
and Preventive Medicine,
New Orleans, La.*

GENTLEMEN:

On page 130, Volume II, No. 2, I find, "Of 1188 examined in Decatur, Ga., all but 8 were found to have hookworm." This statement is incorrect, and should be, in order to conform with the facts: Of 1188 rural school children between the ages of 6 and 18 examined in *Decatur Co.*, Ga., all but 8 were found to have hookworm.

Very truly yours,

A. G. FORT,

Atlanta, Ga., August 20, 1914.

Director of Field Sanitation,

Ga. State Board of Health.

CURRENT LITERATURE

THE TREATMENT OF YAWS AND THEIR SEQUELÆ BY MEANS OF SALVARSAN.—Girling (*Jour. Trop. Med.*, 1914, XVIII, 193) says that salvarsan has revolutionized the whole question of the treatment of yaws, and that it can undoubtedly be looked upon as a specific remedy for the disease. He has treated about fifty patients in various stages of the disease, and in every case recovery has been rapid and complete. He usually gives an intravenous injection of 10 mg. of salvarsan per kilogram of the body weight. One injection has been sufficient to cure. In small children the drug is injected into the muscles of the gluteal region on account of the difficulty of administering it intravenously. He records the case of a boy, aged 16 years, who had been under treatment since 1908 with antiseptic dressings and the internal administration of potassium iodide, mercury and arsenic without result. Among other methods of treatment he was given 24 injections of atoxyl and 10 injections of tartar emetic. In December, 1912, he was given 0.5 gram of salvarsan intravenously. He completely recovered, and has had no recurrence. There is a curious error in the paper. After making the statement that the usual dose of salvarsan is 0.01 gm. the author says he has "been successful lately with a much smaller dose, viz., 0.075 grams per kilogram." He evidently means 0.0075 grams per kilogram, or 7.5 mg. per kilogram.

John M. Swan.

A BRIEF NOTE ON AMEBIC DERMATITIS.—Keng (*Jour. Trop. Med.*, 1914, XVII, 193) describes a dermatitis caused by the growth of amebæ in the tissues of the skin. The disease begins as minute red, hard, discrete papules, suggestive of small-pox, but there is no fever. In a day or two the papules become converted into vesicles, which may attain the size of a small pea. These vesicles then rupture and discharge a serum which forms a crust like that of vaccinia. In some cases the eruption is of

the nature of a diffuse, spreading erythema with pus in the subcutaneous tissues. The fresh pus is thick, white and creamy and contains large granular amebæ, closely resembling the *Entameba histolytica*. After the ulcers have healed the surrounding skin becomes deeply pigmented. The disease is contagious. Amebæ are usually found in the stools, although the patient may not necessarily have had dysentery. In the majority of the cases the disease first appeared in the vicinity of the anus. Septicemia, abscesses, cachexia, and kidney complications have been noted. The disease is to be treated with hypodermic injections of emetine chlorid.

J. M. S.

ANKYLOSTOMIASIS IN THE NORTH NYASA DISTRICT.—(A. G. Eldred, *Jour. Trop. Med.*, 1914, XVII, 209). North Nyasa consists of (1) a narrow strip of almost entirely flat country at the lake level (1,500 feet), about 10 miles in width and 70 miles long, bounded on the east by the lake and on the west by the mountains. Along the lake shore and often for half a mile or more inland the soil consists of pure sand, and more inland of more or less sandy earth. During the rainy season (December to April) this flat country is in many places waterlogged. (2) A mountainous portion composing the remainder of the district, thinly populated, well wooded in many places, and with a soil consisting largely of coarse gravel.

The chiefs and headmen of the various villages have been called in before the Resident and Medical Officer, and the nature of the disease and the preventive measures to be adopted explained to them. They have been shown the type of latrine that should be adopted. Printed notices explaining in simple terms the nature of the disease, and the precautions to be adopted, have been printed and circulated. All infected individuals have been given one course of treatment, either with betanaphthol or eucalyptus oil. It is obviously impossible to re-examine every case, but from nearly 100 cases that the author was able to re-examine it is evident that one course of treatment is frequently inadequate. As a result of the examination of 1,500 people, 650 have been found to harbor ankylostomata; 245 to harbor bilharzia; 91 to harbor ascaris; and 17 to harbor

tricocephalus. Eight hundred and twenty-four, or 55 per cent., have presented infection with helminths. J. M. S.

BRONCHIAL SPIROCHETOSIS.—Harper (*Jour. Trop. Med.*, 1914, XVII, 194), records the case of a male, aged 35 years, who complained of cough, wasting and profuse expectoration, which had never been blood stained, of six months duration. The pulmonary signs were negative except for increased vocal resonance all over the chest. The lymphnodes of the neck and both axillæ were markedly enlarged, somewhat soft in consistency, but not tender. The heart was normal and neither the liver nor the spleen was enlarged. The sputum was clear, nonpurulent, thin and watery and large in amount. It contained very little mucus and a few pus cells. A stained specimen showed numerous spirochetes, which were very thin and delicate. The blood showed the characteristics of a moderately severe anemia. The disease was afebrile. J. M. S.

CANINE BABESIASIS IN PORTO RICO.—Martinez (*Jour. Trop. Med.*, 1914, XVII, 194) has discovered the existence of canine babesiasis in Porto Rico in the course of routine examinations of dogs for epizootic diseases and hydrophobia. J. M. S.

TYPHOID FEVER IN ROCKVILLE, MD.—Report of an outbreak caused by an infected water supply from a deep well.—(L. L. Lumsden. U. S. Public Health Bulletin No. 65, May, 1914.) Rockville, a town of 1,200 population and just outside of Washington, is situated on top of a ridge separating the drainage shed of the Potomac River from that of Rock Creek. For several years the typhoid prevalence has been rather high, but in January and February of the present year an epidemic occurred showing conclusively a general source of contamination, when the author was detailed by the United States Public Health Service, in collaboration with Mr. H. R. Hall of the Bureau of Sanitary Engineering of the Maryland Health Department, to make an investigation. A thorough study of the excreta disposal, water and food supplies, and the epidemiological findings revealed in the water supply a source of infection rather unusual

and that may be duplicated in many other small towns under similar conditions. The water supply was obtained from two wells sunk to a depth of 225 feet. The first 40 feet through clay and the remainder through rock. Both wells have casings that run through the clay to from 20 to 30 feet within the rock. After heavy rains it had been noticed that the water from one of these wells became slightly turbid. Close to the location of these wells ran a closed drain from a nearby spring that also passed within a few feet of an ordinary pit privy. Several weeks prior to the epidemic a case of typhoid had occurred in the house employing this privy, and no precautions had been taken with the disposal of the patient's excreta for several weeks. Uranine was introduced into the drain a few feet below the privy—the drain was stopped up close to the wells, and the pumps worked continuously for several hours, when the characteristic reaction of uranine was obtained from one of the wells. Bacteriologic tests were also made, which gave a high colon bacilli content, showing evident fecal contamination from a cracked casing. A hypochloride plant was designed and installed in several days, the water mains flushed out with a heavy charge, and then the usual sterilization process continued. The epidemic was promptly checked, except for the development of several cases in the first week after sterilization of the water was commenced.

P. L. Querens.

THE METHOD BY WHICH FLEAS INFECT WITH PLAGUE.—(Trans. Ent. Soc. of London for 1913, March 31, 1914, Part IV, pp. CXV-CXVII). Socot, in discussing plague transmission by means of the flea, advocates the latest and most logical theory that infection is contracted by means of the flea regurgitating bacilli into the wound or puncture made for securing its food. Experimenting in conjunction with Martin, using *Ceratophyllus fasciatus* and *Xenopsylla cheopsis* under such circumstances that prevented contamination of the puncture by the fleas' dejecta, mouth infections were accomplished. The bacilli can be readily demonstrated, thriving and multiplying in enormous numbers in the flea's stomach, and the insect gorging itself still further, distends the proventriculus, the blood therein soon

becoming infected, bacilli then occur in enormous numbers here. From here the organisms are most probably regurgitated into a fresh puncture due to the violent efforts of the flea to obtain food for a craving appetite. This theory is being accepted throughout as the most plausible, instead of infection being effected through the insect's feces, which was held until recently.

P. L. Q.

DERMATITIS VENENATA DUE TO RUNGUS.—(*Brit. Med. Jour.*, April 4, 1914, pp. 759-760). Hornsey describes a form of dermatitis due to a species of tree in British North Borneo whose leaves resemble those of the jaborandi, called by the natives "rungus" or "ringus." Within 24 hours of contact with the tree, an intense itching results, which is soon followed by a rash composed of clusters of raised, red papules, first appearing over the part of direct contact, and later becoming universal. The temperature rises with the appearance of the rash, accompanied by a general feeling of malaise; about 48 hours afterwards the papules become vesicles, which later become confluent, burst, and become covered with yellow crusts; severe cases may be complicated with infectious pyogenic cocci, leaving very foul odors. The usual course in mild, untreated cases, lasts from 5 to 7 days, with little disfigurement remaining, but if pus organisms infect the vesicles, permanent disfiguring scars usually result. The disease is most prominent amongst coolies, who work in the jungles and handle these trees.

P. L. Q.

RACHITISM AND OSSEOUS DYSTROPHIES OBSERVED IN YOUNG ANIMALS BORN OF DYSTHYROIDEAN PARENTS.—(*Gazette des Hôpitaux*, April 28, 1914). H. Claude, in the *Presse Médicale*, March 21, 1914, writing on the results of various experimental and clinical observations, says that dysthyroidean heredity deserves to take rank among the potent causes of infantile dystrophies. After syphilis, which retains its pre-eminence as the chief producer of hereditary malformations; after tuberculosis, which causes bony, articular and visceral lesions; after alcoholism, a great factor in producing physical and mental degeneracy, we should place functional thyroid trouble due to infectious altera-

tions, while keeping in mind the toxic rôle played by functional modifications of other glands.

This dysthyroidean heredity might easily be the cause of family dystrophies (bony or articular malformations, myopathies, nervous disorders). It is not unreasonable to suppose that a gland that has such a powerful influence on the development and nutrition of the individual, could be patent in determining a species.

Hereditary defects should be looked for all the more diligently since, in certain cases at least, opotherapy, either simple or combined, seems to bring about a marked improvement.

A. McShane.

SPRUE.—The danger of the introduction of tropical sprue into the southern United States is remarked by H. B. Hiatt, High Point, N. C., and W. Allan, Charlotte, N. C. (*Journal A. M. A.*, August 1, 1914.) People suffering from sprue are constantly returning to us from the Tropics, and inasmuch as many authorities on tropical medicine consider sprue communicable and even infectious, the possibility of its becoming endemic in the Southern States may render it there a public health problem. The comparatively recent introduction of pellagra into this country should be a warning to us. "The clinical picture of sprue consists chiefly of gastro-intestinal symptoms—stomatitis, flatulence with great distention, diarrhea with large, pale, frothy, acid stools, atrophy of the intestinal mucous membrane with diminution in size of the liver and secondary anemia with loss of weight and strength; the course of the disease is chronic with a marked tendency to relapse. The sprue stomatitis consists in a red, bald appearance of the tip and edges of the tongue, sometimes nearly all of it being involved. Aphthous ulcers are common. The edges and tip of the tongue become sensitive and the patient often complains of a burning, pricking sensation, even while the tongue is still apparently normal." The diarrhea starts gradually, at first of the early morning type, with bulky, bad-smelling stools, full of gas bubbles and showing marked evidence of fat indigestion. The loss of weight and strength may cause death from exhaustion. The blood shows the secondary anemia.

They report four cases of sprue, two from Porto Rico and two from China, and one native case which is probably sprue but passed too soon from under observation to make a positive diagnosis. All the cases recovered or improved under treatment. The authors recommend rest in bed as essential, but discredit the use of any drug as a specific. Moderate use of alkalies seems rational, but exclusive meat diet or milk diet seems to them the reverse. The fruit diet is simply a monosaccharid diet and this in conjunction with skimmed milk seems to be the best treatment in severe cases. The advent of cold weather, especially cold nights, seemed to be of greater benefit to their patients than any one remedy. In active cases the patient should not attempt to remain in the tide water or piedmont sections during the hot months. The cases should not be confused with pellagra. The nervous, mental and skin symptoms are lacking and the morning diarrhea and the stools are characteristically different.

CULTURE OF *BACILLUS LEPRÆ*. — (*Interstate Med. Journal*, June, 1914.) Drs. H. G. Irvine and W. P. Larsen report a failure in an attempt to cultivate Hansen's bacillus on artificial media. They excised a nodule from a case of undoubted leprosy, under strict asepsis, and placed small fragments of diseased tissue in Dorset's egg-medium with trypsin, some on coagulated horse-serum, and some on nutrient agar in tubes. The pieces of tissue treated with trypsin were digested in about ten days, and at the points of the tissue deposits enormous numbers of acid-fast bacilli were found. Transplants were made to freshly prepared media (Dorset's egg-medium and coagulated horse-serum, to which trypsin was added) by the simple means of transferring loops of the semi-digested medium, containing the organism, to the new media. After inoculations varying from a few days to ten weeks, the transplants were examined and invariably acid-fast bacilli were present, but it was notable that they were far less numerous than on the original plates. Transplants continued to be made, until finally no acid-fast bacilli were found. The investigators found that they were not really making culture of the organism, but that they were simply transferring and diluting the original batch of bacilli. A series

of animal inoculations was also negative. Drs. Irvine and Larson unite with Fraser and Fletcher in concluding that cultivation of the *Bacillus lepræ* is much more difficult than is generally supposed.*

A. McS.

NOTE ON A CASE OF OSTEOPERIOSITIS DEVELOPING AFTER A PROBABLE ATTACK OF FEBRIS COLUMBENSIS.—(*Jour. Trop. Med.*, 1914, XVII, 177.) Aldo Castellani reports a case of chronic osteoperiostitis developing after an attack of continuous fever said to have lasted six weeks. He isolated a micro-organism from the pus with all the characters of *B. columbensis* (Cast., 1906). The blood of the patient agglutinated the strain isolated from the pus as well as all the strains of *B. columbensis* kept in the laboratory, including the original one isolated in 1905. There can be little doubt in his opinion that this germ has been the cause of the osteoperiostitis, and that the fever from which the patient states he suffered before the periostitis developed, was, according to all probabilities, an attack of "febris columbensis."

John M. Swan.

TREATMENT OF TRICHOCEPHALOSIS WITH FIG-SAP.—(*La Prensa Medica*, Havana, June 15, 1914.) Dr. Posada Berrio, of Medellin, Colombia, contributes a practical article on the treatment of *Trichocephalus dispar*. Trichocephalosis is very common in Medellin, where many people are infested with the worms without suspecting it. Dr. Berrio found that 95 per cent. of the individuals examined were infested. It is important to institute treatment as soon as the presence of the parasite is determined. Thymol has been much vaunted, which, indeed, sometimes gives excellent results; but it often fails to have any effect. Moreover, it is necessary to watch it. Bearing in mind the inconveniences of thymol, Dr. Berrio resorted to a popular remedy in Colombia, the milk (or sap) of the fig tree. The large fig tree (*higueron*) is a species of the genus *Ficus* that grows very abundantly in Colombia. The sap is obtained by

*NOTE.—In the Department of Pathology of Tulane University, Prof. Chas. W. Duval has succeeded in isolating and cultivating the *Bacillus lepræ*. His technic is published elsewhere.

making an incision in the bark. The patient takes 25 or 30 grams of the "milk," and the treatment is completed by administering a dose of castor oil. The results obtained are really admirable and the physicians in that locality use no other kind of treatment. In one case, Dr. Berrio put the patient on thymol, followed by Glauber's salt; one week later he gave thymol and followed it with calomel and jalap. Not a single parasite was expelled. One week later, he gave to the same patient 30 grams (1 ounce) of fig-milk and followed it with an equal amount of castor oil. The result was marvelous, for the patient passed hundreds of the parasites.—*Revue de Med. et d'Hygiene Tropicales*.
McShane.

CASE OF LEPROSY WITH ATTEMPTED CULTURES AND ANIMAL INOCULATIONS.—H. G. Irvine and W. P. Larson. (*Interstate Med. Jour.*, June, 1914.) Patient was a Sicilian, aged 28. In United States three or four years. Disease about four years' duration. Tubercle and nodular type of lesions present. Microscopic examination of lesions proved organisms, which were also found abundantly in the nasal secretions. Wassermann proved negative. 1.6 gram of salvarsan was given on September 29 and the dose repeated on October 7. Slight improvement noted. Cultivation of the acid-fast organisms was attempted: Dorset's egg medium, coagulated horse serum (plus 1% trypsin solution) in Petri capsules, nutrient agar (in tubes sealed with paraffin). Growth occurred in the media treated with trypsin after about ten days. Transplants were made to similar media and after varying periods up to ten weeks, bacilli were found, but always less numerous than on the original plates. Fourteen transplants resulted similarly. Animal inoculations (rabbits) were negative in results. The authors conclude that their experience shows that the *B. lepræ* is more difficult to cultivate than is generally assumed, especially by those who have not attempted its cultivation.
Dyer.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editor as of special interest to the readers of this JOURNAL will be reviewed.

Distribution and Spread of Disease in the East. Protozoa and Disease. The Influence of Climate, Disease, and Surroundings on the White Race Living in the Tropics. (The Stewart Lectures of the University of Melbourne, 1913.) By Anton Breinl. Melbourne, 1914.

Progress Report of the International Joint Commission on the Reference by the United States and Canada in re The Pollution of Boundary Waters. January 16, 1914.

BOOKS.

CLINICAL HEMATOLOGYS AN INTRODUCTION TO THE CLINICAL STUDY OF THE SO-CALLED BLOOD DISEASES AND OF ALLIED DISORDERS.

This is a thorough discussion of clinical hematology. The diseases of the blood, or as the author very correctly says, the diseases of the blood making organs, are discussed from every standpoint and such of treatment as is now available is also given. One valuable part of the work is a new and original classification of blood diseases. If this classification finally meets with approval and adoption, it will fill a long felt want.

C. C. Bass.

REPRINTS.

DYER, ISADORE. The Duty of the Government in Leprosy Care and Control. Rep. from the Journal of the American Medical Association, July 25, 1914, Vol. LXIII.

DYER, ISADORE. The Treatment of Pellagra. Rep. from Texas State Journal of Medicine, July, 1914.

HILL, H. W. The Non-identity of Modern Leprosy and Biblical Leprosy. Rep. from American Journal of Public Health, Vol. 4, No. 7.

HOFFMAN, FREDERICK L. The Chan of Death and the Ministry of Health. Address delivered before the Divinity School, Yale University, New Haven, Conn., March 30, 1914.

HOFFMAN, FREDERICK L. The Significance of a Declining Death Rate. Address delivered before the National Conference on Race Betterment, Battle Creek, Michigan, January, 1914.

TANON, L., and DUPONT, A. Le Traitement de la Maladie du Someil par le Galyi. (International Congress of Medicine, London, 1913.) Tropical Medicine and Hygiene.

UNTERMEYER, SMAUEL. Reasons and Remedies for Our Business Troubles. Delivered before the Commercial Club and the Pittsburgh Industrial Development Commission at Pittsburgh, May 22, 1914.

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CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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VOL. II.

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EDITORIAL

The Cause of Pellagra. During the few years since pellagra was first found to be endemic in certain sections of the United States, the disease has appeared to become more and more important, because of its apparent rapid spread. The number of cases now in this country and the number of deaths that result from the disease each year is simply appalling. The question as to whether this is a new infectious or contagious disease recently introduced, or whether it has existed in the United States, unrecognized, for a very long time, is one on which the students of the disease do not agree. No doubt the majority believe, however, that the disease has not existed to any considerable extent for many years. They think it would have been recognized and if it had not been recognized at the time it would at least be remembered by those physicians who are now familiar with the disease and who have practiced medicine for the past ten to forty or fifty years. If pellagra has existed here only a com-

paratively few years, as the majority seem to believe, we have therein evidence that it is not caused by any specific infectious agent transmitted from man to man, either by contagion or by any known manner of infection. The disease is slow in its development in the individual and lasts for many months or years. If it was highly contagious or infectious one case could be the source of infection of many others. This, however, is contrary to the usual occurrence and when other cases seem to be traceable to a given case the time involved is usually months or years. A contagious or infectious disease spreading so slowly from case to case might reach enormous proportions in a few years in institutions and places where people are crowded together, but it does not seem that it could be distributed over such a very large area as that in the United States in which pellagra is known to exist and to originate. Especially is this true when we consider the class of people mostly affected. Pellagra patients do not belong, as a rule, to the class who travel considerable distances or mingle except with the people of a limited circle or community. It should require certainly very many years for a disease of this nature to be carried from a focus or from several foci to almost every town and country of the entire South and to several States of the North and West. Be it remembered that the disease affects the rural population and those of the small towns chiefly. Recently there have been reported¹ four cases apparently originating at different places in Minnesota.

This and much other evidence against the theory that pellagra is due to some kind of infectious agent has been strongly supported by recent observations by Goldberger.² In the Georgia State Sanitarium a careful study of the records show that "of 996 patients admitted during 1910—excluding those that died, were discharged during their first year, or had pellagra on admission or within a year of admission—there remained at the

institution after one year 418, and of this number 7.65% have developed pellagra since that time." On the other hand, 293 employees, nurses and attendants of the institution have all remained free from the disease, although they have lived "in substantially the same or in identical environment as the asylum inmates for at least one year." It is pointed out that if the disease had developed in the attendants at the same rate that it did in the inmates there should have been 22 cases of pellagra among them.

Another institution studied furnishes even more striking evidence. An orphanage on July 1, 1914, had 211 orphans in the institution, and of these 68, or 32%, had pellagra. In the 25 children under 6 years of age there were 2 cases, or 8%, and in the 66 children over 12 years of age there was only 1 case, or less than 2%, while of the 120 children between the ages of 6 and 12, over 52% had the disease.

A minute investigation has been made at both institutions of all conceivable factors that might possibly explain the striking exemption of the groups indicated. The only constant difference discovered relates exclusively to the dietary. Those free or almost free from pellagra had the best diet. The small amount of fresh animal protein and the large proportion of vegetable diet was very apparent.

On the other hand, we have very strong evidence presented by the Thompson-McFadden Pellagra Commission³ that the disease is certainly produced by some infectious agent and is communicated from man to man in some unknown way. In the light of the observations of Goldberger and others, it is striking that this present study and house-to-house canvass of the homes of over 5000 people living in six endemic foci failed to indicate any definite relation of the disease to any element of the dietary. In fact, the very thorough study of the dietary of pellagrins and nonpellagrins in Spartanburg county, South Carolina,⁴

would seem to prove almost beyond doubt that diet is not a causative factor in the disease. Corn, for instance, has long been charged to be the cause of pellagra. No other single article of diet has been thought by many investigators to be responsible. It was found that of 3,135 persons eating cornmeal daily, 3.1% had pellagra, while of the 681 who ate it rarely or never, 6% had the disease. It would seem, therefore, that abstinence from corn food instead of its use rather leads to the development of pellagra.

A most striking piece of information brought out by the study is the relation of frequency of association between individuals developing pellagra for the first time and persons previously suffering from the disease. There was very definite evidence of intimate association with a preëxisting case of pellagra in more than 80% of the cases incident in 1912 and 1913. Of the 819 persons living in the same house with pellagrins, 6.59% developed pellagra during 1912 or 1913; of all the population of the same mill villages living next door to a preëxisting case, 1.72% acquired the disease; of the remainder of the population living at a greater distance than next door from a preëxisting case of pellagra, only 0.52% acquired pellagra. This evidence is met, of course, by the argument that the dietary conditions that caused pellagra in one member of a household are likely to produce it in other members. This argument may be applied also to some extent, at least, to people living next door to cases of pellagra.

Rather extensive experiments have been conducted to try to communicate the disease to monkeys and the results have failed so far to prove the infectious nature of the disease. The Illinois Pellagra Commission in 1910 attempted to produce the disease by inoculation of material from pellagra patients and also by feeding. Something over 100 monkeys were used, but nothing definite was determined. The Thompson-McFadden Pellagra

Commission has inoculated about 125 monkeys, but nothing definite has been determined. The skin lesions which most closely resembled those seen in human pellagra occurred in one of the control monkeys that had not been inoculated at all. The present writer has had a somewhat similar experience. Of 35 rhesus monkeys inoculated in a variety of ways with a great variety of material from pellagra patients and subjects, none developed anything that very strongly indicated pellagra. One monkey, however, that had not been inoculated at all developed lesions on the hand and forearm that very strongly resembled the skin lesions of human pellagra. This condition developed in less than two weeks from the time the animal arrived from New York. If it had occurred in an inoculated monkey it would probably have been mistaken for pellagra.

Recently Lavinder and his coworkers⁵ reported briefly their experiments attempting to transmit pellagra to monkeys and baboons. Every conceivable material from pellagra patients and subjects was fed or injected. "In all, 103 experiments have been made in which material collected from pellagrins during life or at necropsy was introduced into the stomachs of the animals; 52 experiments were made in which pellagrous fluids were injected, and 96 in which extracts, suspensions or emulsions of pellagrous tissue were injected." The animals were exposed to the sun's rays by being kept in glass-covered houses.

In only one instance has there occurred indications suggesting pellagra. One monkey, 20 days after a first injection of cerebrospinal fluid from a pellagrin and 2 days after the second injection of similar material, developed skin lesions at the forearms and hands that resembled and ran the course with recovery of human pellagra.

A complete clinical picture of pellagra was produced by experimental inoculation of a rhesus monkey by Harris.⁶ The

writer had the privilege of seeing this animal at the time the disease was active, and there is not the slightest doubt but that the disease was certainly pellagra. I should look with great doubt upon any theory or claim as to the cause of the disease which is not able to explain, at least, this case of experimental pellagra.*

C. C. Bass.

The Journal of Parasitology. The initial number of the *Journal of Parasitology* has made its appearance with a representative editorial board and with Prof. Henry B. Ward of the University of Illinois as Managing Editor. The *Journal* is announced as "a quarterly devoted to Medical Zoology," and in the announcement it is stated that the appearance is guaranteed for three years. It is projected as the medium of "prompt publication of briefer papers and research notes on animal parasites" and it is not ready to accept monographs nor papers exceeding ten to fifteen pages.

The appearance of this publication would seem to have been demanded by the students of parasitology in this country, until now dependent upon individual publication, the medical periodical with mixed purpose, or in a medium printed outside of the United States.

The first number presents a variety of topics, all of current interest, such as "The Destruction of the Vitality of the Cysti-

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2. Goldberger, Jos. The Cause and Prevention of Pellagra. U. S. Public Health Report, Sept. 11, 1914, p. 2354.

3. Siler, J. F., Garrison, P. E., and MacNeal, W. J. Introduction to the Second Progress Report of the Thompson-McFadden Pellagra Commission. *Archives of Internal Medicine*, Sept., 1914, p. 289.

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5. Lavinder, C. H., Francis, Edward, Grimm, R. M., and Lorenz, W. F. Attempts to Transmit Pellagra to Monkeys. *Jour. A. M. A.*, Sept. 26, 1914, p. 1093.

6. Harris, W. H. The Experimental Production of Pellagra in the Monkey. *Jour. A. M. A.*, June 21, 1913, p. 1948.

cercus Bovis by Freezing (B. H. Ransom),” “Study of Insects in Relation to Pellagra (A. H. Jennings),” “Variation in Oxyurias (S. B. Fracker),” “Observations on the Eggs of Ascaris Lumbricoides (N. D. Foster),” “Dr. Nott’s Theory of Insect Causation of Disease (W. A. Riley),” “Rhabditin, Contribution to a Science of Nematology (N. A. Cobb),” “Experimental Ingestion by Man of Cysticerci of Carnivore Tapeworms (M. C. Hall),” “A Peculiar Morphologic Development of an Egg of the Genus Tropicocerca, etc. (W. D. Foster),” and “The Action of Arsenical Dips in Preventing Tick Infestation (H. W. Graybill).”

Not only is the array of subjects important but the contributors and the material offered are of the first order.

We may leave the subject matter for further review, noting only the prominence once more given to the pioneer scientific acumen of Nott, who in 1848 anticipated the modern ideas of the causation of malarial fever, yellow fever and other insect-borne diseases. In his essay on Dr. Nott, and referring to Nuttall’s earlier discussion of Nott’s theory, Dr. Riley makes a statement regarding our sending Nuttall an “abstract” of Nott’s paper. We are sure that Dr. Riley has had no intention of imputing a careless or indifferent record of Nott’s work to us in the “abstract” mentioned, but there is a suggestion that Dr. Nuttall’s information was not reliably complete, and this we desire to correct. Dr. Riley’s tribute to Nott’s genius and scientific ability more than compensates this inadvertence, and it must be appreciated by those of us who have been privileged to have lived in the spirit of the traditions and teachings of Dr. Nott, long before general recognition was given him by scientific men at large.

The special study of parasitology has not appealed to many until recent years, but in the development of preventive medicine as it relates to disease, particularly insect-borne, in and out of

the medical profession there will be a demand for more knowledge presented in a current form. This new journal specially devoted to this field should grow in usefulness as its purposes expand.

Engaged in one of the outlying fields which touches the work of this new comer, THE AMERICAN JOURNAL OF TROPICAL DISEASES AND PREVENTIVE MEDICINE extends a frank welcome and a God-speed.

Isadore Dyer.

ORIGINAL ARTICLES

THE PROPAGATION OF AMÆBIC DYSENTERY IN ANIMALS AND THE RECOGNITION AND REPRODUCTION IN ANIMALS OF ATYPICAL FORMS OF THE DISEASE.*

By

ANDREW WATSON SELLARDS, M. D.,

and

WALTER ALBERT BAETJER, M. D.,

(From the Medical Clinic of the Johns Hopkins Hospital.)

Outline.

I. Intracecal Method of Inoculation:

1. Results of usual methods of inoculation;
2. Technique and results of intracecal inoculation;
3. Diagnostic possibilities;
4. Biological study with reference to pathogenesis, morphology, and chemotherapy.

II. Continuous Propagation of Amæbic Dysentery in Animals:

1. Present status of literature;
2. Continuous transmission of a strain with especial reference to:
 - (a) choice of material and care in preservation during handling.
 - (b) choice of animals for inoculation;
3. Effect of continued passage on clinical course, morphology, and virulence of the amœbæ;
4. Correlation with previous results and relation to general laws of protozoan infection.

III. Bearing of Amæbic Dysentery in Animals Upon the Interpretation of Clinical Symptoms:

1. Typical symptoms in man which have been reproduced in animals;
2. Features in man which have not been reproduced in animals;
3. Features in animals which were not established for man;
4. Comparison of pathological lesions in man with lower animals.

*Presented at the Eleventh Annual Meeting of the American Society of Tropical Medicine, held at Boston, May 29 and 30, 1914. This paper represents a summary of a series of four articles published in the Bulletin of this Hospital, beginning in June, 1914.

IV. Clinical and Morphological Consideration of Atypical Strains:

1. Description and frequency of cases;
2. Morphology;
3. Reproduction in animals;
4. Systematic position of atypical strains.

Introduction.

In order to arrive at a complete understanding of any of the infectious processes occurring in man, it is essential to recognize, not only the causative agent, but also to cultivate this agent artificially and to secure infections in lower animals for the study of the clinical and pathological course of the disease. In amœbic dysentery two of these factors have been accomplished in the recognition of the organism and the production of the typical disease in animals. Many factors still remain obscure, however, which could certainly be most readily understood, if it were possible to overcome the difficulties which have so far prevented the artificial cultivation of the parasitic types of amœbæ. Several authors¹ have, it is true, thought temporarily that they had succeeded in accomplishing this result, but it has since been proven that the species of amœba which was cultivated has in all cases been one of the limax group occurring in accidental association with the true pathogenic organism. Certainly the organism grown has never conformed to the pathogenic type in its morphology or in its ability to produce the disease in animals. It is generally accepted, therefore, that the two parasitic amœbæ of man, *Entamœba histolytica* and *Entamœba coli*, have not been cultivated successfully.*

In an experimental study of amœbic dysentery, undertaken during the past year, a number of features relating to various phases of the disease have been noted which are interesting, both

*In accordance with the view advanced by Walker,² we consider that *E. tetragena* of Viereck is not a new species, but that it is identical with *E. histolytica* of Schaudinn. In this paper we have frequently used the term "amœbæ" in a vernacular sense to designate either the free living or the parasitic forms, although many writers refer to the parasitic amœbæ of man only as entamœbæ and never use the broader term "amœbæ" in reference to them. The choice between the terms *Entamœba* and the older term *Endamœba* is a complex problem in nomenclature; we have used the usual term *Entamœba* pending a final decision upon this point by the nomenclatorial board.

from their bearing on the disease in animals, as well as in the interpretation of some of the conditions found in man. The object of this study was originally an attempt to secure a continuous propagation of amœbic dysentery in animals to make it possible to keep material constantly on hand for study under experimental conditions.

The most interesting points brought out during the course of this investigation can be conveniently taken up under the following groupings:

1. Results of various methods of inoculation;
2. Continuous propagation in animals;
3. The bearing of experimental dysentery on the interpretation of the clinical symptoms in man;
4. Clinical and morphological consideration of certain atypical strains.

Results of Various Methods of Inoculation.

The technic of inoculation used by practically all investigators for the production of dysentery in animals has been by one of two methods; either by feeding material containing cysts, or by direct injection per rectum of bloody, mucous stools rich in trophozoites and cysts. It is generally accepted that kittens are the most favorable subjects and some authors have even emphasized the particular age at which the resistance is lowest. The per cent of infections obtained has been extremely diverse, varying from a complete failure to infect,³ up to the usual average of 25 to 50%, and even a maximum of 65%⁴ of positive inoculations. The uncertainty of these results is not satisfactorily explained by the two natural suggestions of lack of virulence in the organism and individual variation in the susceptibility of the animals used; while these factors doubtless have some influence, it seems probable that there are many minor factors that are definitely concerned. The attempts of various authors to secure the propagation of dysentery through a series of animals have failed even under the most favorable conditions. Consequently it seems that we could hope for little success in continuous propagation unless some new method could be found

which offered the possibility of increasing the percentage of infections. In the study of amœbæ there are several purposes for which it is very desirable to secure a more efficient method of infecting animals. It seems that some advantage might be expected from exposure of the large bowel by laparotomy and making a direct inoculation through the wall into the lumen. After some preliminary attempts the following routine was adopted:*

A small incision is made in the abdomen in about the mid-line, thus exposing the caecal region. A syringe needle of moderate bore is inserted at an angle into the lumen of the bowel so as to form a valve, if possible, and the material is then injected. After withdrawing the needle, the puncture wound may be cauterized, or the serosa sutured over it, if there is any tendency to leakage. We have never been troubled by the development of peritonitis on the first transfers from man to animal by this procedure, and the same statement usually applies to the first few subtransfers from animal to animal. After that, however, the increased virulence of the accompanying bacteria may make peritonitis a troublesome complication and necessitate the reversion to inoculation by rectal tube. Fortunately, after a few subinoculations in kittens, the amœbæ often increase in virulence and infection per rectum becomes more certain.

It has been suggested that *E. histolytica* is unable to penetrate the healthy mucosa. Accordingly, in the early experiments the mucosa was scarified slightly with the syringe needle at the site of injection and macerated a little by rolling the gut between the thumb and finger. The amœbic lesions, however, did not develop at the site of this injury; accordingly, this treatment was discontinued on account of its tendency to lead to early inflammatory complications of bacterial origin. The results by this method have given practically 100% of infections in all animals which did not die within the incubation period, and with strains of amœbæ from different sources, some being obtained from extremely mild cases. This is rather high in comparison with the much smaller percentages reported with the rectal tube and feeding methods, even when one inoculates

*All operations were carried out under general anesthesia (ether).

large numbers of amœbæ from active cases. Several reasons suggest themselves in explanation of the higher percentage of infections following an inoculation into the caecum as compared with an injection by a high rectal tube.

Perhaps the most important are that intracecal inoculation frequently does away with the necessity of mixing the infectious material with diluting agents, and that the material can be injected directly against the mucosa, avoiding any injection into fecal masses in the bowel; and also the long period after laparotomy (with ether) without intestinal evacuation is a distinct advantage, for this is so likely to occur after an injection by rectal tube.

The results obtained by this method of inoculation suggest a possible field of usefulness diagnostically. This would perhaps occur in some of the atypical diarrheas of long duration, associated with the presence of occasional atypical amœbæ in the stools. Except for those extremely well versed in the morphological differentiations, and one might almost say in spite of it, we occasionally see cases in which it is extremely difficult to attach any importance to the rôle played by a few amœbæ that may occasionally be present in the bowel. However, from the study of several examples of these atypical cases it has been possible to definitely establish the atypical amœbæ as the cause of the symptoms. These cases will be considered more fully later. It seems not impossible that infection may be obtained in typical cases in the interim between recidives under circumstances when one suspects the presence of amœbæ in the stools, though they may be too few in number to be detected microscopically. A more precise method of infection also offers a definite means of studying more easily the changes in morphology of some strains, as well as a more satisfactory determination of certain of their biological characteristics, such as changes in virulence, or their behavior toward therapeutic agents.

Continuous Propagation in Animals.

Considerable interest centers around the attempts to secure the continuous propagation of amœbæ in kittens, a result which has not been accomplished and which for the most part has

been regarded as impossible on account of the relative insusceptibility of these animals and a supposed degeneration and loss of virulence on the part of the amœbæ upon sub-inoculation. In the majority of attempts at transmission thus far reported, the strain has died out, or lost its power to infect, after the third or fourth transfer, and frequently earlier, although on one occasion successive passages through as high as six animals were obtained by Werner.⁵ As the result of some recent researches, Darling,⁶ in a series of publications, describes definite morphological changes of a degenerative nature, the so-called "small generation" developing early in the sub-inoculations from one animal to another, resulting in what Darling terms, the development of maturation and senility of a strain. The one exception to these conclusions has been that of Wenyon⁷ who, although his strain was lost after the fourth generation, nevertheless concludes that the loss was due to accident and not to any change in virulence.

The results obtained during the past year by use of the method of intracecal injection, described above, combined with injections by rectal tube, have given quite different results in our hands. In short, we have been able to transmit the infection through eleven successive generations in cats without finding evidence of either decrease in virulence or morphological changes in the amœbæ, provided they are obtained from the site of active lesions. As a matter of fact, quite the reverse has been found. This strain, therefore, differed from those previously reported, not only in the larger number of passages that were obtained with it in animals, but more especially in the retention of its full virulence and its characteristic morphology. In view of this evidence the strain was allowed to die out as it seemed unnecessary to continue the propagation any further.

Since these results differ so radically from those of the preceding observers, it is perhaps well to take up briefly some of the points which seemed important in insuring the continuous propagation of any strain. Although the case that we were dealing with was not a very early one, and not very acute clinically, it is possible, of course, that we were fortunate in securing a strain of unusual vitality. It has been stated by some, however, that

the infection can be carried farther, by several passages, if the material used is taken from a patient in his initial attack. The material used in this series was obtained originally from a patient who had contracted the disease three years before in the Philippines, and who had had several courses of emetine therapy during two acute recidives. The inoculation of the first animal was made with material obtained during a typical acute exacerbation and after the patient had been receiving $2/3$ gr. of emetine (hypo.) for three days.

During the course of this study we were impressed particularly with the necessity of selecting material for transfer at the first onset of symptoms when the dejecta consisted almost entirely of blood and mucous, containing but little fecal matter and abounding in active trophozoites. Material taken later in the course, after the infection had become chronic, or at autopsy, proved to be distinctly less satisfactory.

It was apparent also that the organisms were preserved much better and longer if no diluting agents were used. When these were necessary, tap water, or 0.2% of sodium chlorid in tap water, proved satisfactory. Rapid transfer was, of course, deemed essential and in the majority of instances all of the animals were inoculated within an hour after the material was obtained. The material was preserved better at room temperature than in the incubator.

As regards the choice of animals, our experience corresponds to that of other observers. Kittens, one-half grown, or younger, were most susceptible and whenever possible were used exclusively. Adult cats were distinctly more resistant to infection.

Considerable difficulty was experienced on account of the increasing virulence of the accompanying bacteria; after the third or fourth transfers this became so marked that it was at times practically impossible to avoid a general peritonitis after injection into the cecum. Fortunately the virulence of the amœbæ increased also and permitted the return to rectal injection until the later transfers, when the bacterial virulence diminished somewhat and we were able to inject directly into the cecum, though with the increase in virulence of the amœbæ,

the rectal injections were satisfactory. The disease was uniformly fatal in the young animals and the incubation period showed marked constancy in the early passages, but became definitely shorter in the fifth and sixth passages. In the animals which died there was almost invariably a fatal septicemia which was due in practically all instances to a small micrococcus belonging to the streptococcus group. The development of septicemia played a most important role in the infection in cats and is quite sufficient to explain in some instances the loss of strain reported by other observers, inasmuch as the animals frequently die unexpectedly during the night, after which the amœbæ in the intestine degenerate rapidly, often failing to infect even if injected immediately post-mortem. This is especially true if the material used for subinoculation is taken from the lumen of the bowel, but can be partially avoided if the intestinal contents are discarded and scrapings from the mucosa are used.

The effect on the clinical course, the morphology and virulence of the amœbæ is interesting, and, in view of previous results, surprising. Instead of a loss of virulence, longer duration of the disease and a higher per cent of recoveries, we obtained precisely the reverse. The incubation period, which was just six days in the animals of the first few passages, was later generally reduced; in one case it was less than three days, with death on the next day following the first appearance of symptoms. Morphologically the typical organisms obtained from the stools at the onset of symptoms, or from the site of active lesions at autopsy, showed no evidence of diminution in size, loss of mobility or of degenerative changes in their structure. On the contrary, they remained active and well preserved, differing in no essential from those of the earlier passages.

A careful consideration of the possible causes of failure in previous attempts to propagate amœbic dysentery makes us feel that those failures were not due to degeneration and loss of virulence in the amœbæ. The evidence from various sources of increasing virulence upon subinoculation of several strains

of amœbæ makes us feel confident that the majority of the strains of pathogenic amœbæ could be propagated for a relatively long period. Indeed, it seems rather definite to us that the behavior of the pathogenic amœbæ conforms quite well to the general laws of protozoan and bacterial infections. A number of points also suggest that these findings may perhaps be perfectly well correlated with the results of other observers. In the first place, the degenerative changes described by Hartman¹¹ and Darling⁶ do occur especially late in the course of the disease in an infected animal. However, if such an animal is sacrificed and an examination made of the active lesions, we have always found it possible to obtain an abundance of virulent amœbæ, typical in morphology. As an example of how easily a strain may be lost accidentally, we found that on two occasions, when the virulence of the accompanying bacteria was at its height, we were practically dependent on one animal for the continuation of the strain, although as many as six or seven had been used to insure a single passage. In the previous reports of animal inoculations it is to be noted that frequently, comparatively little attention has been directed toward the selection and preservation of the infective material and the details of inoculation.

Clinical Course in Man and Animals.

It has been very interesting to note the marked similarity of the clinical course of the disease in animals and its bearing upon the interpretation of some of the symptoms in man². With the exception of a few of the rarer complications, such as brain and splenic abscess which are reported in the literature, practically all of the conditions occurring in man are found also in experimental animals. In the majority of the younger animals the disease manifested itself as a typical acute, fatal infection, with an incubation period of unusual constancy, and ending in death at an early date, without cessation in the acute dysenteric symptoms. In other cases, especially in adult animals, chronic infections were produced with typical remissions and periods of acute relapse, such as

characterize the course of chronic infections in man. One of these extended over a period of eight weeks. Many of these terminated in recovery, and in one the carrier state developed. One chronic animal developed a large liver abscess which was interesting chiefly from the light it might throw on some clinical cases with symptoms of an acute hepatic inflammation, but which on aspiration at operation are apparently negative. In this instance a large area of the right lobe of the liver was swollen, soft and necrotic. On section this abscess abounded in large trophozoites, but contained no pus nor fluid which could have been aspirated. Very few bacteria were present; in fact, their presence was only determined by the appearance of occasional isolated colonies upon culture media. The occurrence of liver abscess, of course, has been previously reported, and in this instance serves to emphasize the possibility of overlooking it in man on exploration, even when it is accompanied by physical signs and symptoms.

A more interesting feature, however, which was found with great frequency in animals but which is not especially emphasized in man, is the occurrence of septicemia. This had a most important bearing, both on the course of the disease, and on the cause of death. It was present in practically 100% of the fatal cases, which included almost all of the younger animals infected. This occurred equally in the animals infected by the rectal tube method and in those inoculated directly into the caecum, and in no instance have we seen death due to a pure amœbic infection. It certainly seems probable, at least, that septicemia must occur at times in man, in view of the bacterial abscesses, gangrene of bowel, and peritonitis, which, in some instances, appear as complications of the amœbic infection. This is practically proven by the positive bacterial cultures obtained by Strong¹⁰ from various organs studied at autopsy. In 76 fatal cases 5% succumbed from a general terminal infection with pyogenic cocci. It would be extremely interesting to know whether this possibility of septicemia might not have some relationship to the acutely fatal cases in the tropics which do not respond to emetine.

No experimental evidence was found to support the view that extensive amœbic lesions of the intestine can develop without dysenteric symptoms.

Pathologically, also, the lesions seem quite similar, except that almost invariably in cats the lesion is in the lower quarter of the large bowel, whereas in man the lesions predominate in the region just below the ileocaecal valve, and those cases where the infection is primarily in the rectum and sigmoid are in the minority. The acute cases showed a swelling and edema of the mucosa, giving rise to a fungoid, granulomatous appearance of the lesion, and, in some cases, to almost complete occlusion of the lumen. In more chronic cases the ulcers were usually small and multiple, with some undermining. The most striking feature, however, was the almost invariable location of the lesion near or in the rectum.

Recognition of Atypical Cases of Amœbic Dysentery.

In addition to the comparison of several typical strains of dysentery in animals with their course in man, we have been fortunate in having the opportunity to see the effect of inoculation with several atypical strains. This proved particularly interesting in a diagnostic sense, since the organisms in the stools of the patients were so scarce and so atypical morphologically that there was no justification for considering that they bore any etiological relation to the disease in the patient. The striking reproduction of a clinical picture in animals similar to that existing in the patient with the appearance of numerous amœbæ in the stools, established the etiological relationship of the organism to the disease from which the patient suffered.

Without going into details of the symptoms occurring in these patients, they all showed a clinical picture characterized by mild but continuous diarrhea, usually without any blood or mucus in the discharges, and without the usual periods of remission and acute exacerbation. Furthermore, the amœbæ were very scarce, and showed an unusual morphology, being somewhat smaller in size and more especially in containing a

nucleus rich in chromatin, which bore little resemblance to the chromatin-poor histolytica nucleus. Emetine was ineffectual in all of these cases.

On account of the atypical history, scarcity and unusual appearance of the organisms, they were at first thought to have little or no connection with the patient's symptoms. One of the cases presented the typical picture of Hirschsprung's disease, while another had the proctoscopic findings of the so-called syphilitic proctitis.

In one of these cases repeated attempts at cultivation of these amœbæ failed completely, thereby excluding the possibility that we were dealing with one of those rare cases in which it is suspected that the limax group may colonize in the intestine. The injection of rather large amounts of material into the cecum of animals gave the surprising result of an almost exact duplication of the findings in the patient. In one kitten, after an incubation period of one month, a continuous watery diarrhea developed which did not interfere with the general health or growth of the animal. This strain on two successive passages through cats, showed definite changes in morphology, characterized more particularly by a nucleus poorer in chromatin than those seen in the patient, but richer than in the histolytica-type of nucleus. These cases and experiments will be reported in detail in a separate communication.

It is very difficult to know just where to classify these organisms, since they do not correspond either morphologically or in the clinical symptoms, in patient or animal, to any of the known species. Two possible interpretations, of course, suggest themselves at once; first, that we are dealing with a new variety, causing a distinct disease clinically, or that we had only the usual pathogenic type which had been much modified, both morphologically and in its pathogenicity, by the long continued existence under, perhaps, unfavorable conditions in the human host.

In view of the confusion already existing in regard to the various types of pathogenic amœbæ, it seems to us unjustifiable to consider this as a new species, or even a new variety. We

prefer to regard these cases, at least for the present, as infections with atypical *E. histolytica* which has undergone certain changes in morphology as well as in virulence, for it is possible that supposedly fixed morphological characteristics of the entamæbæ may be subject to variation under certain conditions.

Summary.

I. The inoculation of infective material from virulent and also from distinctly avirulent cases of amæbic dysentery directly into the cecum of kittens has given practically 100% of infections as compared with the usual result of about 50% of positive infections when virulent material is fed or injected per rectum.

II. Injections by intracecal methods has been of service in:

1. The continuous propagation of a strain of dysentery;
2. The determination of the etiology of some obscure diarrheas;
3. It also offers certain advantages in diagnosis and in the study of the morphology and biology of the entamæbæ.

III. Continuous propagation of one strain of dysentery through eleven passages, with a definite increase in virulence and with retention of the typical morphology, has been obtained. Especial attention was given to the following points:

1. Avoidance, as far as possible, of the accompanying bacteria by selection of mucus and blood practically free from fecal matter.
2. Inoculation of amæbæ obtained during the first day or two of symptoms.
3. Avoidance of diluting agents.
4. Avoidance of degenerated amæbæ by sacrificing animals, if necessary, and obtaining material from the lesions in the mucosa.

IV. Degenerative changes described by Hartmann and by Darling do occur in infected animals, especially in spontaneous stools and in autopsy material, but by sacrificing the animals we were able to demonstrate, in addition to these degenerated

forms, an abundance of typical virulent amœbæ in the lesions in the mucosa.

V. A careful consideration of the possibilities for the loss of a strain of amœbæ by accident during sub-passage in animals leads us to feel definitely that the view, accepted at present, that the sub-passage of amœbic infection is self-limited, is definitely erroneous.

VI. The clinical course of the disease in animals is strikingly similar to that of human infections:

1. The following features occur both in man and animals:
 - (a) Acute fatal infections,
 - (b) Chronic infections with relapses and liver abscess,
 - (c) Development of the carrier state.
2. Certain features have not been reproduced in kittens:
 - (a) Intestinal amœbiasis with extensive lesions without dysentery,
 - (b) Rare complications, such as brain and splenic abscess.
3. One important feature, bacterial septicemia, is common in animals, but has not been rigidly established in man;
4. The pathology in man and animals is similar in its fundamental characteristics, but differs in the exact distribution of the lesions.

VII. Some obscure diarrheas were investigated which were characterized by continuous watery discharges without periods of intermission and with the presence of a few atypical amœbæ in the stools. From a morphological standpoint, no etiological importance could be attached to these amœbæ. Animal inoculations proved definitely, however, that these organisms were responsible for the symptoms.

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SPIROCHÆTÆ AND FUSIFORM BACILLI IN VARIOUS LESIONS IN THE PHILIPPINES.*

By

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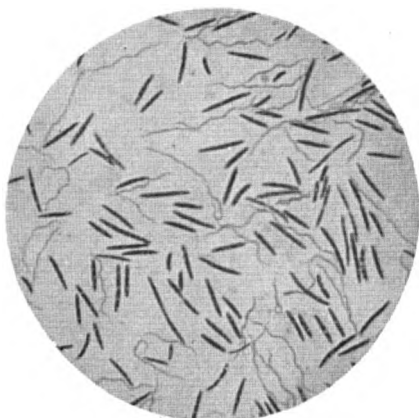
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Over 30 years ago W. D. Miller of Berlin described spindle-shaped bacilli and spirochetes which he encountered during his studies regarding the bacteria of the mouth (1). In 1894 Plaut, and two years later, Vincent, called attention to the occurrence of a spirillum associated with a fusiform bacillus in ulcerative lesions of the fauces and oral cavity (6) (21) (22). This condition, an ulcero-membranous angina, is now quite generally spoken of as "Vincent's angina," and has been found to be widely distributed and of frequent occurrence. From time to time reports have been made of the finding of these organisms in localities other than the mouth and throat.¹ In some instances it appeared that the extra-oral infections had their origin in the buccopharyngeal cavity, either as a result of bites, or through direct extension from the throat. The occurrence of these two organisms in tropical countries, especially in ulcers of the skin, has been noted by several observers. In the Philippines I believe that the finding of fusiform bacilli and spirochetes was first reported by Bloombergh (5). Subsequently I studied the occurrence of these organisms

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1. Fusiform bacilli associated with spirochætæ have been demonstrated in noma, ulcerative stomatitis, diphtheria, carious teeth, hospital gangrene, appendicitis, brain abscess, fetid bronchitis, gangrene of the lung, pyorrhœa alveolaris, syphilitic lesions of mouth and fauces, ulcers of the skin, caries in the nose, lobar pneumonia, septic hand-infection, and in apparently normal mouths and tonsils. (3) (4) (6) (7) (8) (9) (10) (14) (15) (21) (22) (25).

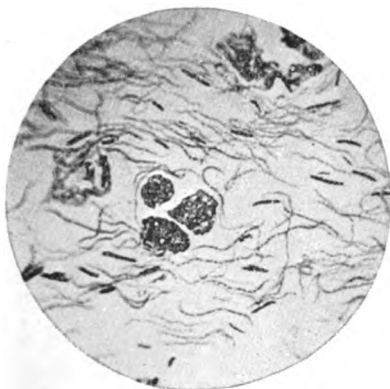
Fusiform bacilli without mention of spirilla or spirochetes have been reported in brain abscess, pyemia, abscess of lung, appendicitis, bronchiectasis, empyema, and in peritonitis following endometritis. In most of these cases other bacteria were present. (11).



1



3



2



4

ILLUSTRATING PAPER OF DR. CHAMBERLAIN

1. Spirochetæ and fusiform bacilli from an ulcer of the gum.
2. Spirochetæ from an ulcer of the tonsil. Shows beaded staining of spirochetæ.
3. Spirochetæ from an ulcer of the foot in a Filipino.
4. Spirochetæ from an ulcer of the foot in a Filipino.

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during two years, and was, as far as I am aware, the first to report from the tropics the presence of spirochetes and spindle-shaped bacilli in the sputum from patients with pulmonary lesions (2) (3) (4).

Although a considerable amount of time has been devoted by many observers to the study of Vincent's organisms during the last ten years, yet we are still much in doubt as to their nature and action. They have been grown in pure culture under anaërobic conditions by Weaver and Tunnicliff on ascitic agar slants (7) (13), by Peters on Dorset's egg medium (13), and subsequently by several other observers (11) (12). Miller, Plaut and Tunnicliff believe that the bacilli and spirochetes are different forms of a single micro-organism. Most investigators have been able to isolate only fusiform bacilli in cultures from their cases (17). Some consider the organisms to be protozoa. In the lesions themselves spirochætæ and fusiform bacilli are almost always present in association with various other bacteria, and there is little agreement as to which are the pathogenic factors. Lasagna considers that the principal part in the development and maintenance of the lesion is due to the fusiform bacillus (17). He found that in animals the injection of pure cultures did not cause death, but produced local necrosis. Dick (11) decided that in pure culture *Bacillus fusiformis* was not pathogenic to animals.

Since Vincent's organisms may be found occasionally in healthy mouths and fauces, and since in disease they may be associated with a variety of other bacteria (usually streptococci and staphylococci), it is always a matter of doubt as to whether any significance should attach to the finding of a few, or even a great number of spirochetes and spindle-shaped bacilli. Some have suggested that a diagnosis of Vincent's angina should be made only when the two symbiotic organisms are present in *preponderating numbers*. Such a distinction is far from satisfactory, but possibly may be of some clinical use, and is to a certain extent adhered to in tabulating my cases. It is certainly a striking fact that in many lesions enormous numbers of the bacilli and spirochetes are seen in a smear, while there are few and sometimes no other organisms visible.

During two years in Manila I examined 106 patients with various lesions in the mouth or throat, with a view to determining the presence of fusiform bacilli and spirochetes in smears from the exudates. In 53% of these cases the organisms were found present in greater or less numbers. In 34% of the patients they were either the exclusive or the preponderating organisms seen in the smears. The number of positive findings was highest in ulcers of the tonsils and the gums. Out of twenty-seven lesions which were considered to be syphilitic, the organisms of Vincent were present in great numbers in ten, and in small numbers in one. The diagnosis was not unassailable in all of these presumably syphilitic cases, but in several in which fusiform bacilli and spirochetes were demonstrated in large numbers the diagnosis of syphilis was confirmed by the presence of a positive Wassermann reaction, the finding of *Treponema pallidum*, or the existence of unmistakable luetic signs outside the mouth.

In four cases in which the Klebs-Löffler bacillus was found culturally there were no Vincent's organisms. In 44 cases in which Vincent's organisms were present, often in large numbers, no diphtheria bacilli were found on culture. Other observers, working in the temperate zone, have occasionally found Klebs-Löffler bacilli associated with spirochetes and fusiform bacilli.

Nearly all of the patients showing fusiform bacilli and spirochetes were young adult males, for the most part American soldiers. A few Filipinos were examined, but only one showed these organisms and then only in small numbers.

Among the patients who were infected with great numbers of spirochetes and fusiform bacilli the clinical appearances were so lacking in uniformity that no diagnosis based on signs or symptoms would have been of value. As shown in the table below the locations of the lesions were diverse. Two ulcers had white exudate on the surface; 8 were covered with grayish membrane, while others were red and bleeding. Among the 25 patients showing throat involvement, fever was present in 6, dysphagia in 16, and prostration in 1. Many of these cases strongly suggested diphtheria, but on culture were negative. Among the lesions of the gums 3 were very painful and

2 were painless. Most of the ulcerations were acute, but 7 were chronic, some having existed for several months.

The location and character of the different lesions are shown in the following table:

Occurrence of Spirochætæ and Fusiform Bacilli in Throat and Mouth Lesions in Manila.

CHARACTER AND LOCATION OF LESIONS	SPIROCHÆTÆ AND FUSIFORM BACILLI		
	Present in preponderating numbers	Present in small numbers	Absent
Ulcers of tonsil, cause uncertain	16	9	8
Ulcers of tonsil, probably syphilitic	4	0	5
Ulcers of faucial pillars, probably syphilitic	0	0	3
Ulcers of gums (ulcerative stomatitis)	6	3	3
Ulcers of gums, probably syphilitic	1	0	0
Ulcer of cheek, cause unknown	0	0	1
Ulcer of soft palate, probably syphilitic	2	0	1
Ulcer of tongue, probably syphilitic	1	1	1
Membrane on tonsil, cause uncertain	2	4	6
Mucous patches, syphilitic	2	0	4
Chancre of tongue	0	0	1
Chancre of tonsil	0	0	1
Aphthous stomatitis	0	0	5
Diphtheria, tonsillar	0	0	4
Tonsillitis, acute, follicular	3	5	6
Sprue, ulcers in mouth	0	0	1
Carcinoma of soft palate	1	0	0
Total	38 ^a	22	50

The associated organisms of the so-called Vincent's angina are probably much more common in all parts of the world than is usually supposed, and they would be more often demonstrated if the practice of making smears from the lesions met with in the mouth and throat were general. Rodella found the two organisms in about 33% of the 2000 cases of pseudo-membranous anginas which he examined (7). Beitzke demonstrated them in 5 out of 58 patients suspected of having diphtheria, and Lublo-

a. The discrepancy between 38 in this column and 34 positive cases reported above is due to the fact that in 4 of the cases there were positive lesions in two different localities in the throat and mouth.

witz reports the presence of fusiform bacilli in 6 out of 38 ulcers of the mouth. Holm found *Bacillus fusiformis* the predominating organism in 73 out of 265 cases of suspected diphtheria in Michigan (24). In none of these instances is the percentage so high as in my series in Manila. Since coming home I have examined in New York State 16 lesions like those studied in Manila and have found the associated organisms in only two cases, in each of which the fusiform bacilli were extremely infrequent.

From a consideration of the above facts it appears that fusiform bacilli associated with spirochætæ in lesions of the mouth and fauces are likely to be met with among white men in the Philippines more frequently than is the case in temperate climates.

I will now consider the occurrence of spirochætæ and fusiform bacilli in lesions of the lung. In 1910, under the name of "Bronchial Vincent's Angina," Rothwell, in Missouri, reported 4 cases in which there were asthmatic symptoms, bloody expectoration and a sputum swarming with spindle-shaped bacilli and spirochetes (15). Cases of fetid bronchitis and pulmonary gangrene in which these organisms were present have also been described in the temperate zone. In symptomatology and appearances of sputum Rothwell's cases remind one of bronchial spirochætosis, as first described by Castellani in 1906, except that Castellani did not report finding any fusiform bacilli. Bronchial spirochætosis has been reported from the Philippines by Jackson, by Phalen and Kilbourne, and by myself.

In 1910 I met with a Filipino patient in Manila who was passing through a severe attack of typhoid fever. His expectorations *were swarming with spirochætæ and there were present also a few fusiform bacilli exactly similar to those seen in the so-called Vincent's angina* (4). The sputum was odorless, thin and watery, contained small grayish flakes and at times was blood-stained. The spirochetes and fusiform bacilli persisted for several weeks during convalescence. Microscopical examination showed no tubercle bacilli, and inoculation of the sputum into a guinea pig was without result. It is of interest to note that one week before the bloody sputum appeared this patient

had a sore throat with a patch of exudate on the left tonsil. Cultural tests for diphtheria were negative, and the exudate did not show any spirochetes or fusiform bacilli in smears³.

The spirochætæ in this man's sputum averaged about 15 microns in length, were thin and delicate, and extremely motile. They resembled the third class described by Castellani in bronchial spirochætosis, except that none were seen having one blunt end. The fusiform bacilli were large, canoe-shaped and on staining showed transverse unstained bands or stripes.

I referred above to the case of pulmonary spirochætosis reported in the Philippines by Phalen and Kilbourne in 1909. Their report mentioned that a few large bacilli were present, but did not give any description of them. As their stained smears were still in the laboratory of the Tropical Board, I reëxamined them and found a few perfectly typical fusiform bacilli which had the characteristic banded appearance when stained.

Following the detection of the above cases I examined the sputum of 32 patients in Manila who had cough and expectoration. None of these contained any spirochetes except one which had an extremely few thick spiral organisms such as might have entered the sputum from around the necks of the teeth where such forms are not infrequently found. No fusiform bacilli were seen.

A peculiarity which I noted in the staining reactions of the spirochætæ, both in these pulmonary cases, and in the ordinary lesions in the mouth, may perhaps account for the fact that spirochete infections of the sputum have been reported but rarely. The spirochetes come out clearly with ordinary dyes, such as diluted carbol-fuchsin, Læffler's methylene-blue or Giemsa's stain, but they did not take the color at all when treated with *sulphuric-acid-methylene-blue* as ordinarily used in Gabbett's method for demonstrating the tubercle bacillus. Therefore, it is evident that any spirochetes present in the

3. At the same time this patient was under observation I had another Filipino, also suffering from severe typhoid, who expectorated material similar in gross appearance to that described above except that it was not blood-stained. This sputum contained enormous numbers of spirochætæ for a period of several months, but no fusiform bacilli were ever found. This was a pure case of Castellani's bronchial spirochætosis.

sputum would be overlooked in making a routine examination for tubercle bacilli by the Gabbett method.

I have met with spirochetes and fusiform bacilli in still another part of the body in Manila, that is in an ulcer of the skin. The patient was a Filipino with an ulcerated area on the foot which was thought to be due to yaws. Smears from the lesion were being stained in our laboratory by Major H. D. Bloomberg, Medical Corps United States Army, but instead of showing *Treponema pertenue* there were found great numbers of spirochætæ and fusiform bacilli which at once suggested the appearances seen in Vincent's angina. The spirochetes were slender and delicate in outline, ranging from 15 to 50 microns in length. The bacilli were from 5 to 15 microns long, and presented the usual barred appearance on staining. Many were identical in appearance with the *Bacillus fusiformis* of Plaut and Vincent, but on the average the ends did not seem quite as sharp as are those of the organisms seen in throat and mouth lesions. Unfortunately this patient passed from observation before these smears were examined. Consequently no history, photographs or cultures were obtainable.

Ulcerations of the skin containing spirochætæ and fusiform bacilli appear to have been reported first by Vincent, who believed the so-called "tropical ulcers" were due to them (8). The presence of these organisms in such ulcers was confirmed by Smith and Peil in Sierra Leone, Patton in Aden, and many other observers in different parts of the tropics. In 1910 Howard reported that spirochetes, usually associated with *Bacillus fusiformis*, were found in nearly all foul-smelling neglected ulcers in Nyasaland (18). In 1911 W. J. Bruce reported similar lesions, usually situated below the knee, under the name of "Zambesi Ulcer."

It is still uncertain how frequent in the Philippines are cutaneous ulcerations associated with spirochetes and fusiform bacilli. After seeing the case above described I examined a large number of ulcers without again finding these organisms. Several workers in Manila told me that they had never met with them. The late Capt. Armin Mueller, Medical Corps United States Army, informed me he had seen several similar cases

near Iloilo, P. I. In 1906 Shattuck reported on 34 chronic ulcers in the Philippines. Five of them contained spirochetes, some of which, he says, resembled *Spirochætæ refringens*, while others were intermediate between that organism and *Treponema pallidum* (20). He makes no mention of finding fusiform bacilli, but in his photomicrographs there appear some large, not very clearly defined, bacilli which somewhat resemble *Bacillus fusiformis*.

In ulcers of the skin, just as in the lesions of the mouth and throat, the role played by spirochetes and fusiform bacilli has not yet been worked out. Howard believed the spirochætæ were the cause of the lesion because on section they could be seen spreading into healthy tissue in advance of other microorganisms. Shattuck considered they were not of etiologic significance because he found them only in the exudate and not at all in sections. In concluding I wish to say that in my opinion the finding of fusiform bacilli and spirochætæ in a lesion of the throat or elsewhere does not justify one in resting content with a diagnosis of "Vincent's Angina." It has been shown that they may be associated with syphilis, diphtheria, carcinoma and mercurial poisoning. These, and probably other etiologic factors, must be carefully ruled out before making the diagnosis of "Vincent's Angina." Furthermore it is still an unsettled question whether the two associated organisms are ever the cause of the multiform lesions in which they are found.

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Discussion.

DR. GEORGE C. SHATTUCK, Boston, Mass.: In some cases of ulcer that I studied in Manila, I found spirochetes present in 5 out of 30 cases; but at that time I did not know of the association of bacillus fusiform with the spirochete.

DR. S. BURT WOLBACH, Boston, Mass.: I have found spirochetes and fusiform bacilli in phagedenic ulcers in Gambia. I have succeeded in staining them in section of tissues in 4 cases in which they were found deep in the tissues. I am inclined to think that these organisms have an etiological significance.

DR. THEOBALD SMITH, Boston, Mass.: The spirochetes may take an intermediate etiological position. They may be the factor which keeps the ulcer progressing, the bacillus fusiformis being the organism which starts ulceration.

MR. FRANK G. HAUGHWORT, New York City: Has spirochete dentium been found?

DR. WESTON P. CHAMBERLAIN, Plattsburgh Barracks, N. Y.: In the photomicrographs made by Dr Shattuck very few fusiform bacilli are to be found. I do not mean to deny that the organisms are of etiological significance; but I do think that their etiological significance has been proven. *Spirochaeta dentium* has not been recognized as such.

DR. E. E. TYZZER, Boston, Mass.: There is a disease which occurs in turkeys, known as black head, which is similar to the solid necrosis described by Dr. Sellards in some of his animals.

DR. RICHARD P. STRONG, Boston, Mass.: The pathogenic amebæ so far have not been cultivated. Did Dr. Sellards find any cats among the experimented animals, which were naturally infected with amebæ? Many monkeys and many guinea pigs show amebæ in their stools.

DR. C. C. BASS, New Orleans, La.: In our experiments with amebic dysentery in kittens, the animals sometimes died after large doses of emetine. They were found to have necrosis of the ileum. This occurred once in a healthy kitten and twice with kittens infected with amebæ. If kittens are used in experiments instead of cats, we have had uniform success in producing infections, and if cysts are used instead of motile organisms, a high percentage of takes can be obtained.

DR. MAURICE COURET, New Orleans, La.: In my experience it has been difficult to produce dysentery or abscess of the liver by material obtained from acute cases of amebic dysentery. In kittens and monkeys abscesses of the liver have been produced; sometimes by feeding, sometimes by rectal injection, and sometimes by direct injection into the portal vein. It is impossible to recognize species of the amebæ by the arrangement of the chromatin in the nucleus. At present we cannot be sure that there is more than one pathogenic form of amebæ.

DR. PHILLIP E. GARRISON, Boston, Mass.: Have any notes been kept concerning the presence or absence of the intestinal worms in the animals used for experimental purposes? Such notes might be productive of interesting facts concerning the influence of these parasites on infection with amebæ.

DR. ANDREW W. SELLARDS, Baltimore, Md.: Young kittens were used almost exclusively in our experiments. Adult cats, however, are comparatively easy to infect. Guinea pigs were discarded because they were so susceptible to bacterial invasion. None of the animals contained intestinal parasites to begin with. In one case an animal had limax, which was discovered by cultural methods. In typical cases of amebic dysentery the stool contains trophozoites only. It is difficult to obtain encysted forms. If a positive method of inoculation could be worked out, it would improve the study of atypical forms of amebæ. The presence of atypical forms is not sufficient ground for considering atypical forms to be degenerative forms. Many of our animals had intestinal worms; but no classification was carried out on this basis. In the strain of the amebæ, which was carried through eleven passages, emetine had been used; but no cyst forms of the amebæ were present.

FURTHER NOTE UPON THE OCCURRENCE OF ENDA- MŒBA MORTINATALIUM AS A HUMAN PARASITE.

By

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Several years ago the writers presented a brief article (*University of Pennsylvania Medical Bulletin*, September, 1910) upon the occurrence in the kidneys, liver and lungs of a still-born fetus at term of certain protozoa which they identified as amœbæ and for which, as a new species, they proposed the name of *endamœba mortinatalium*. In the following number of the same journal (*University of Pennsylvania Medical Bulletin*, October, 1910) a note was added to this paper referring to discoveries by Ribbert over twenty years previously (*Centralbl. f. allgem. Pathol.*, 1904, no. 23, p. 945) in the kidneys of a syphilitic new-born infant, and twice later on in the parotid glands of non-syphilitic infants, of protozoa of similar character, and by Jesionek and Kiolemengolou (*Münchener Med. Wochenschr.*, 1904, no. 43) of similar organisms in the kidneys, liver and lungs of a syphilitic eight-months fetus.

The latter authors at the time suspected the parasites were causal for syphilis; but this, of course, could not be maintained. In the instance published by us there was no history or evidence available in the least suggestive of luetic factor. Comparison of the morphological features of the protozoa met by the writers in histologic sections with the drawing and descriptions of the above authors led to the belief, still maintained, of their identity with those in at least Ribbert's first case and in that of Jesionek and Kiolemengolou. No trace of the source or mode of infestation was recognized in any one of these instances.

The parasites as pictured and described by us showed them to be naked amœbiform cells, round or oblong, or pyriform or

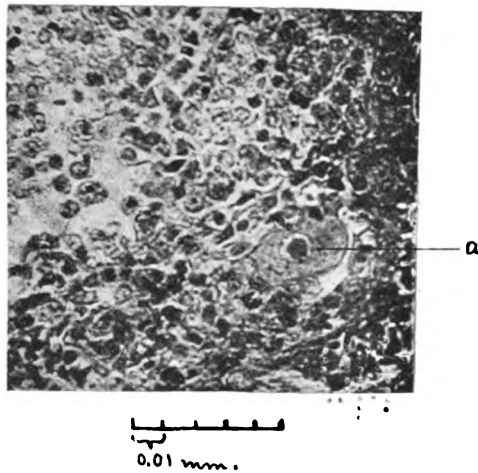
irregular in shape from the extension of pseudopodia. The largest measured had a long diameter of 0.038 mm. and transverse diameter of 0.025. The smallest certainly identified was 0.022 mm. in diameter. Pseudopods when present were limited to one or two short and thick examples. Occasionally a thin border of ectosarc could be seen extending more or less completely about the cell; but the pseudopodial projections and their bases consisted of finely granular to hyaline ectosarc. The endosarc was coarsely granular, often showing large deeply chromatin-staining granules believed by the writers to be chromidia. The cells were vacuolated, some of the vacuoles containing ferrophilic granules, and probably of food-vacuole type; others empty and perhaps of degenerative origin. The nucleus was relatively large, usually measuring from one-third to one-half the cell diameter. It was round or oval in shape, with a large karyosome, very rich in chromatin and only in some instances showing a centriole. The karyosome was surrounded by a well defined clear zone in which a few chromatin threads and granules were to be seen; and this by a well defined nuclear membrane. Undoubted reproduction forms were not seen by us; although suggestion of division of the karyosome may be noted in several of the camera-lucida sketches of individuals met with. In the kidneys and liver these parasites were invariably found in small suppurative foci but in the lungs were encountered in the alveoli free from surrounding cellular infiltrations. No associated bacteria were demonstrable by staining methods in these foci of suppuration, the destructive changes in which were doubtless due to a proteolytic power possessed by the amæbic parasites themselves. Histologically these foci consisted of the more or less degenerated parenchyma, with a rich focal infiltration by many mononuclear and fewer polynuclear leucocytes, together with one or a few of the parasites. In the opinion of the writers their morphological features, even in the absence of acquaintance with the living, motile organisms or of their reproductive phases, differentiated the parasites from known endamæbæ and justified the proposal of the specific name above mentioned.

Recently in the histologic examination of material from the

body of a two-month-old female white child who died in the Philadelphia General Hospital from pneumonia (U. S. Path. Hist., 4400) amœbic parasites of apparently the same species were encountered by the writers. The patient was regarded by the clinicians as syphilitic, because of ulcerous eruptions about the mouth and nose and scaly lesions of the buttocks and arms; and, although this diagnosis was not confirmed either by a definite luetic history of the parents or by a Wassermann test, it was borne out by the coincident finding at autopsy of marked fibrosis of the thymus, along with an organizing lobular pneumonia and chronic interstitial pancreatitis. The parasites were found only in the lungs; not, as in our first case, in the liver and kidneys also. The pneumonia was of a peculiar type; the right lung being uniformly over the greater part of the whole organ consolidated and pale in a thin subpleural layer, while the central portion was deep red, fleshy and nearly solid. Microscopically the red interior presented an irregular consolidation, with the vesicular walls thick from injection of their capillaries, marked cellular infiltration and swelling of the lining cells. Scattered vesicles were free from exudate and a number were filled with a highly albuminous fluid exudate which had been fixed as a hyaline content. For the most part, however, the vesicles contained, along with a minor amount of fibrin, a mixture of erythrocytes, a few polynuclear and mononuclear leucocytes and many larger cells of embryonal connective tissue type. Mingled with these here and there the parasites were met, never in aggregations, and only sparsely scattered throughout the section. In the pale subpleural pneumonic area organization was advancing, the connective tissue cells appearing as fibroblasts; and an excess of formed fibrous tissue was to be seen. Several small caseous foci in this area were found, never with the histology of definite tubercles; and special stains for tubercle bacilli failed to show the latter organisms. No other morphological changes, aside from widespread parenchymatous degeneration, were met; the intestines were normal to gross inspection.

Careful comparison of the amœbic cells in this case with those of our former case, has led the writers to regard them as identical. A photomicrograph of the pulmonary tissue with

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ILLUSTRATING PAPER OF DR. A. J. SMITH

Photomicrograph of endamoeba in lung (a ; the parasitic cell measures 32.x20 micromillimeters; nucleus measures 10 micromillimeters. From section of lung of syphilitic infant; stained with hæmatoxylin and cocin).

one of the organisms in the midst is exhibited. The size of the parasites is the same (as, too, the nuclear appearance) as above detailed from our previous case, and need not be here repeated. No further suggestion is given in the very meager history available in the hospital records in the matter of source or mode of acquirement. The case is published for record in correlation with previous reports of this parasite. Its occurrence in this case again in a syphilitic is, to say the least, suggestive for speculation. It is quite possible that Ribbert's two parotid cases were aberrant mouth amœbæ; and were these excluded three of the four cases now known have been in syphilitics (or if Robbert's parotid cases be included, three out of six). Etiological significance in this relation, as Jesionek and Kiolemen-golou suggested, cannot, of course, be considered, but it may be possible that a syphilitic infection may constitute a favoring circumference for infestation by these amœbæ and their development and distribution in the body. Although the present instance, by the discovery of the parasites in a child two months old, departs somewhat from the rule of previous instances in occurrence in still-born individuals, it merely indicates that the intrauterine period of life is not alone suitable for their presence in the host; and it may well suggest that with further experience we may be confident of the primary infestation of the mother and that its intrauterine invasion is but a secondary extension from some as yet unknown focus in her. Doubtless the parasites are harmless for the adult mother; while for the fetus, especially when impaired by luetic taint, they may well prove pathogenic and capable of destroying life.

BUBONIC PLAGUE: A STUDY OF A TYPICAL CASE.

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Introduction.

Bubonic plague is a disease which, at one time or another, has visited practically the entire civilized world. Although it is not essentially a tropical disease, it has shown its most terrific effects in tropical and subtropical countries, probably because the conditions of climate and of native civilization there found were most favorable to its propagation.

It would seem that present-day plague started in a province of Western China in 1893, reaching Canton in January, 1894, and spreading from there to Hong Kong. In 1895 it also appeared in Amoy, Macao and Foochoo, and in 1896, besides recurring in Hong Kong, it appeared in Bombay. In the following year Bombay, the Punjab and Madras were visited. Since then it has been slowly and steadily spreading, not only about the original foci but abroad in the world as well. At the present time it is endemic in a number of widely separated localities, among them New Orleans, and, according to the latest advices, has most recently appeared in Liverpool.

In the United States, however, very few cases have been seen except in San Francisco, and comparatively few American medical men have had the opportunity to study the disease. In view of its spread in recent years, and its probable appearance in still other seaboard cities in the future, especially in those which trade with territory in which the disease is established, it seems that more attention should be paid to the disease than has been the case.

In June of this year the earliest local cases appeared in the

Charity Hospital*. But a short time before the case which is the basis of the following study occurred, one of us had the fortune to perform an autopsy on a case of *B. pestis* infection which had not been diagnosed as such before death. With this warning of the presence of the disease in the city, we were able to make the diagnosis in the present case early in its course, and, it being so unusual an opportunity to become acquainted with the disease, a complete clinical and laboratory study was made of it.

Case History.

On June 26, 1914, at 11 p. m., C. L., a white male 49 years of age was brought in by a hospital ambulance and examined in the admitting room by Dr. L. A. Fortier.

On account of his clouded mental condition no history could be obtained from him other than the statement that he had been sick for two days. On the following day his friends said that he had been in New Orleans for the past eight weeks and that about sixteen hours before admission to the hospital he had complained of headache and malaise. He remained quietly in his room all day, and when seen in the evening was found to be delirious.

Examination revealed a well developed and nourished, apparently vigorous man, evidently very acutely ill. The axillary temperature was 104° (F.), the pulse 120 and the respiration 32 per minute. The face was flushed and the eyes injected. There was tenderness in the left femoral and inguinal regions, causing the patient to object to palpation. The lymph nodes here were discrete, firm and only moderately enlarged. No edema was present. Examination of chest and abdomen revealed nothing abnormal. The patient was admitted to a general ward with a diagnosis of toxemia, cause unknown. Since the condition suggested some form of septicemia an immediate blood culture was requested, which was taken at about midnight.

At 9 a. m. of the day following admission the left femoral nodes were still tender, discrete, freely movable and but moderately enlarged. The temperature was now 105° (F.), and the pulse still 120. When seen again at 11 a. m., a change in ap-

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pearance was noted. The individual nodes were palpable, but had increased considerably in size and were not distinctly separated. At 1:30 p. m. this enlargement was still greater, and a doughy infiltration was found to extend about one inch below the gland mass, the entire region being exquisitely tender. The abdomen was slightly distended but not tender. A few moist rales were heard posteriorly in both lungs. No eruption could be found at this time. The pulse was full, bounding, and 112 per minute; the temperature was 105° (F.), and the respiration 38 per minute. The patient was still semidelirious, obeying orders such as to sit up or lie down only when these were insistently given. Blood examination gave a total white cell count of 18,750 per cmm. Differential count (200 cells): Neutrophils 92%, lymphocytes 4%, large mononuclears 4%. A Widal's reaction was negative. The blood culture taken at admission showed no evidence of any growth in 15 hours. Having in mind the possibility of the case being one of bubonic plague, and considering the severe illness and the rapid change in the femoral region, aspiration of those glands to remove material for diagnostic purposes was thought indicated. This was done at 2 p. m., and stained smear preparations declared positive for *B. pestis*. The patient was immediately isolated.

At 10 p. m. the temperature had fallen from 105° to 101°, with a pulse rate of 110. During the night the temperature continued to fall until at 4 a. m. it registered 99.5°, with a pulse of 100. This continued until about 7 a. m. of the 28th, when it began to rise. During this period the mental condition was quite clear, but speech was hesitating and the facial expression dull and depressed. Two small blue-black spots were observed at this time, one on the inner aspect of the left thigh, and the other on the chest. At 1 p. m. the temperature had risen to 103° and the pulse increased to 130, the respiration rate being 32. Retention of urine was noted.

From this point on the patient became progressively worse. With but a slight remission the temperature rose until at 5 p. m., when the last record was made, it was 104.5°. At about 3 p. m., the patient became cyanosed. The nurse's notes record the appearance of hemorrhagic spots over the surface of the

body, particularly the chest. These were not observed by either of us, when the patient was seen at 6 p. m., probably on account of the fact that he was dying at that time. From 4 p. m. the patient was very helpless, turning and moaning frequently. The pulse was rapid and thin, the respirations somewhat labored. The extremities became cold and the general cyanosis deepened.

To those who witnessed it, the death of the patient was very impressive. His condition had remained apparently the same for two hours, except for a gradual increase of the surface congestion. At 6 p. m. the writers, together with several others, were in the isolation ward for the purpose of examining another patient when it was noticed that, almost without warning, the upper portion of the body became so deeply cyanosed as almost to warrant the nurse's record that "the body turned black shortly before death." The body was seen to become rigid, respiration ceased and the face and neck swelled and assumed a livid, purplish hue, much as would be seen in a death from strangulation. The pulse disappeared subsequently to the cessation of respiration.

Clinical diagnosis: Bubonic plague.

An autopsy was begun within one and one-half hours post-mortem by Dr. C. W. Duval, director of the pathological department of the hospital, to whom we are greatly indebted for permission to use the following:

Autopsy Protocol.

The *body* is that of a well-developed, rather obese white male. Body length 170 cm. No rigor mortis present; the body is still warm. The pupils are equal and measure 4 mm. Lividity is very marked over the thighs, abdomen, neck and face, the discoloration being somewhat irregular and patchy. A number of small hemorrhagic areas are seen which do not disappear on pressure. In the left femoral region, there is felt a mass in the deep structures which extends from the apex of Scarpa's triangle to Poupart's ligament. The subcutaneous tissues about this mass is boggy and pits on pressure. There is an old cicatrix in the skin of the left inguinal region. Careful examination of the lower extremities reveals no abrasion or breaks in the skin.

There is a well marked talipes equinus of the right foot. The left axillary glands are markedly enlarged, while the right femoral, inguinal and axillary nodes, though palpable, are not enlarged.

On opening the *peritoneal cavity* the abdominal fat is seen to be 3 cm. in depth. The omentum is moderately long, filled with fat and free. The peritoneum is smooth and glistening. Both the greater and lesser cavities are free from excess fluid or other abnormalities. The retro-peritoneal tissues in the region of the left portion of the pelvis are edematous and hemorrhagic, both conditions being readily observed through the over-lying peritoneum. The appendix measures 13 cm. in length and directs inward and downward over the brim of the pelvis. Many of the mesenteric lymph nodes are enlarged, though on section they show nothing worthy of note. The diaphragm extends to the fifth rib on the left and to the fifth interspace on the right.

Lymph Nodes: The median line incision was carried from the symphysis pubis outward to a point midway over Poupart's ligament, and then downward to the knee. On laying back the skin flap the subcutaneous tissues throughout Scarpa's triangle, as well as the tissues of the left retroperitoneal region as far as the bifurcation of the common iliacs, are found to be extremely edematous. So great is the edema in some places that the tissues appear semi-solid jelly. Scattered throughout the edematous tissues are numerous small and large areas of hemorrhage which are most marked in the tissues beneath Poupart's ligament and about the left chain of retro-peritoneal lymph nodes. On cutting down through the serum-soaked tissues, the underlying lymph nodes are found enormously enlarged and in most part fused together. Sections through the glands show in many instances extensive peripheral hemorrhages, while in others the blood extravasations are of a petechial nature and scattered through the gland substance. In addition to the hemorrhages, the necrosis is striking; in the larger nodes practically the whole parenchyma is acutely necrotic and waterlogged, presenting a moist, yellowish-white spongy appearance. Some of the smaller glands which are necrotic show hemorrhage confined to the periphery with the necrosis more central. The

largest gland mass is found in the femoral region and measures 5 cm. in length by 2.5 cm. in breadth. The chain of enlarged retroperitoneal glands on the left side encroaches on the aorta and vena-cava, pushing them considerably to the right side. On section, through this cord of fused glands, the hemorrhages in general are more diffuse than those of the femoral and inguinal regions.

The *pleural cavities* contain a few old fibrous adhesions binding the upper right lobe to the chest wall; otherwise the cavities are negative.

The *heart* is enlarged and weighs 550 grams. Beneath the epicardium of the left ventricle and auricle are numerous petechial hemorrhages. In one place near the apex, these hemorrhages are confluent and the overlying epicardium is dull, lusterless and finely granular. The pulmonary artery, opened in situ, contains soft postmortem clot. The myocardium presents a reddish-brown color, and is normal in consistence. The muscle does not permit fragmentation with the force of the finger. The endocardium and valves are negative; the coronaries are negative. The aorta shows numerous yellowish-white patches and streaks along the arch. Measurements: Tricuspid valve 10 cm., pulmonary valve 7.5 cm., mitral valve 10.5 cm., aortic valve 7 cm., left ventricle wall 2 cm., right ventricle wall 8 mm.

Both *lungs* are voluminous and on section show marked congestion and edema, particularly in the dependent parts. There are no areas of consolidation or evidence of inflammation in the bronchi and their terminals. The glands at the root of the lung and in the mediastinum are slightly enlarged; however, on section they show no evidence of necrosis or hemorrhage.

The *spleen* weighs 375 grams. The capsule is tense and the shape of the organ is almost that of a sphere. On section the splenic tissue bulges forward beyond the cut edges of the capsule. The color is dark red, while the consistence is fairly firm. Scattered through the parenchyma are innumerable hemorrhagic areas. These are most marked about the malpighian bodies. A moderate amount of pulp comes away on scraping. The

trabeculæ are obscured. Smears from the organ shows innumerable Gram negative bipolar bacilli.

The *liver* weighs 2220 grams. The capsule is smooth and edges rounded. On section the organ presents a light reddish-brown color and is extremely friable in consistence. Smears show numerous Gram negative, bipolar staining bacilli. The gall bladder and ducts are patent. There are no gallstones.

The left *kidney* weighs 240 grams, the right 340 grams. The capsule is tense and strips readily from a clean cortical surface. The stellate veins are markedly injected. On section the normal markings are poorly defined. The malpighian tufts are readily discerned as elevated, pin-point red dots; the pyramids are deeply injected. The cortex in general measures 1.1 cm. in thickness. There are a few retention cysts in the cortical substance of both organs. The peri-ureteral tissues on the left side in the iliac fossa and as far the entrance to the bladder are extremely edematous and in places hemorrhagic.

The left *adrenal* on section shows diffuse hemorrhage in the cortex, though most marked at the lower pole of the organ. The right adrenal appears normal.

The organs not mentioned are negative. Head not opened.

Anatomical Diagnosis: Bubonic plague; acute hemorrhagic adenitis of the left femoral, inguinal, retroperitoneal and axillary lymph nodes; acute septic splenitis; acute and chronic nephritis; hypertrophy and dilatation of heart; epicardial hemorrhages; congestion and edema of lungs.

Bacteriological.

In this case it was, from the first, a comparatively simple matter to obtain material for bacteriological study, for the femoral bubo when aspirated was of considerable size and yielded several drops of a blood-stained, rather serous fluid.

Smears were made at the bedside and stained upon return to the laboratory. Examination showed them to be filled with large and smaller cells, many identifiable as lymphocytes and others as endothelial cells. Between them was seen serum and granular necrotic material and, lying free in this background, innumerable bacilli. With a simple Loeffler's blue stain these

were seen to be plump, sometimes ovoid, bacilli of fairly large size, the most of which presented a striking bipolar concentration of the protoplasm. Some of them were large, almost round, and showed so thin a shell of protoplasm that they seemed about to burst. On the other hand, many individuals stained quite uniformly. With Gram's stain they decolorized and took the counter-stain.

The presence of large numbers of bacilli of the above description in smears from an acute bubo of a clinically suspicious case is fairly diagnostic of plague. It should be emphasized, however, that very early in a case, even though the symptoms are alarmingly pronounced, the organisms in a smear may be few in number and difficult or impossible to identify. In many glands, enlarged both acutely and chronically, there may be found at least a few organisms of diphtheroidal character which, with any simple stain, might be mistaken for *B. pestis*.

Cultures in the case under consideration were made at the bedside by running one or two drops of aspirated material from the syringe onto neutral agar slants, Loeffler's blood serum slants and into tubes of neutral bouillon. In 24 hours the growth was evident in all of these. On the neutral agar it was thin, moist, grayish and quite translucent. With the loop it was seen to be quite sticky, stringing out on withdrawal of the loop from the surface of the culture.

Smears from this showed almost entirely solidly staining bacilli of moderate size, rather plump and with rounded ends. No capsule could be demonstrated. A few long, irregular, lightly staining involution forms were seen. Cultivated upon 3% sodium chlorid agar at a later date, much more involution was seen. On the serum the growth was heavier than on agar, slightly yellowish in appearance and less tenacious to the touch. Morphologically the individuals were shorter, smaller and relatively thicker. Few involution forms were seen. In the bouillon little growth occurred under 48 hours. Smears showed short chains made up of almost coccoid individuals, resembling involuted streptococci. In semi-solid growth occurred uniformly along the line of planting, showing the organism to be a facultative anærobe. No evidence of motility was seen here; the or-

ganism was proved non-motile by a study of a hanging drop preparation. No gas was formed in dextrose media, although in dextrose serum water acid was produced with coagulation of the medium.

Smears and cultures were made from the lymph-nodes and organs at the autopsy. The findings in all of these were similar to those described.

The final test of *B. pestis* is, of course, biologic. Two guinea pigs were inoculated from cultures isolated from this case, one of them subcutaneously, the other cutaneously, by applying the organisms to a slightly abraded skin surface. The former animal died within three days, the latter in four days. Both showed evidence of plague, macroscopically and microscopically, and the culture of *B. pestis* was recovered from the lesions.

Histological.

The tissues which are found to suffer the greatest damage from the invasion of *B. pestis* are the lymph-nodes along the entrance tract, the spleen and the kidneys.

The destruction in different nodes varies in degree with their position in the body, and their consequent relation to the zone of bacterial infiltration. The most of the nodes in the primary and secondary buboes are so thoroughly disintegrated as to be scarcely recognizable. Hemorrhagic blood, both fresh and necrotic, is found irregularly massed throughout. The connective tissue shows marked destruction, the walls of the smaller vessels being irregular, loose and fragmented and the capsule and trabeculae of the nodes largely degenerated. Extensive infiltration of polymorphonuclear leucocytes is seen throughout, but nowhere in great enough degree to suggest abscess formation. The more distant nodes show congestion or even hemorrhage, with a varying degree of endothelial leucocyte proliferation.

The spleen shows great congestion, amounting to hemorrhage in places. Many small areas of necrosis with fibrin deposit are found in which great numbers of bacteria can be determined. Polymorphonuclears are numerous.

The kidney shows congestion similar to that seen in all of

the organs, together with a marked granular degeneration of the parenchymal cells and, in many of the glomeruli, a deposit of strands of a fibrinous exudate. This acute degeneration is quite in keeping with the rapidly overwhelming toxicity of the infection.

Summary.

Such is, somewhat briefly, the study of a case of plague. Given a case in which there is a sudden onset with marked prostration, severe headache, vomiting, high temperature, and early delirium, in which there is found a focus of lymphatic enlargement and tenderness, the possibility of *B. pestis* infection should be considered.

The diagnosis of a case cannot, as a rule, be made positive without a bacteriological study. This is to be carried out on material secured by gland aspiration, smears of which usually show very numerous typical bacilli. The rather characteristic growth on different media, with the usual involution forms on salt agar, together with the demonstration of lack of motility and of the habit of producing acid without gas in dextrose media, make the diagnosis so certain that the death of guinea pigs inoculated with gland material is merely confirmatory.

The essential features of sections of the tissues in this infection are acute inflammatory infiltration, dissolution of connective tissue, hemorrhage, edema, and the presence of great numbers of the bacilli in the tissues along the invasion tract.

TUBERCULOSIS IN TROPICAL COUNTRIES AND THE NECESSITY FOR GREATER EFFORT TO PREVENT IT.

By

ISAAC W. BREWER, M. D.,
Taughannock Falls, N. Y.

The importance of preventing tuberculosis is not fully appreciated by many who have the administration of the sanitation in tropical countries.

The white man who goes from a temperate climate to the Tropics usually finds life there so different and so enchanting that he naturally expects to find a certain mystery about the diseases endemic in those regions. True it is that many of the diseases encountered are strange and their cause obscure, but it will be found that a goodly part of the sickness and of the deaths are caused by diseases which are common in temperate regions. In all probability tuberculosis is one of the greatest causes of sickness and death in the Tropics.

During my service in the Philippines this fact so impressed me that at the first meeting of the Far Eastern Medical Society a paper giving the statistics for the city of Manila was presented. In that paper the cause of the high mortality was discussed and some of the measures of prevention that seemed most applicable to the problem were considered.

The paper was copied in the lay press but was not very well received by the medical profession, most of the members of which were engrossed with the more inviting problems of dysentery, beri-beri, cholera and parasitic diseases. The Director of Health for the Philippine Islands rather belittled the importance of the disease, saying that it caused about the same proportion of deaths in Manila as in temperate regions. He seems to have changed his opinion, for in the last annual report issued from his office he says: "As evidence accumulates it is becoming more and more apparent that the people of the Philippine Islands are

afflicted with tuberculosis to perhaps even a larger extent than the people of other countries, and much larger funds must become available for combating this disease."

My knowledge of tropical conditions is based upon six years residence in the Philippine Islands and of the conditions there I am able to speak from personal observation. Vital statistics in that region are far from reliable; the only semblance of accuracy is in the City of Manila, where, although there are some errors, it is believed the number of deaths attributed to tuberculosis is under rather than over the actual figure.

During the six years ending with June 30, 1913, there were in the City of Manila 8,244 deaths from tuberculosis, which is over six hundred more than the total number of lepers culled from all portions of the archipelago during the period from 1906 to 1913. During the fiscal year ending with June 30, 1913, there were in Manila 1412 deaths from tuberculosis, and during that same period there were reported 1,585 cases of the disease.

For the same period the Director of Health reports that there were throughout the Archipelago, not including Manila, 13,887 deaths from tuberculosis. These last statistics are without doubt less than the actual number. They surely indicate that as far as the Philippine Islands are concerned tuberculosis is still entitled to be called "The Captain of the Men of Death."

It is believed that the conditions in the Philippines are in no wise unique. Dr. G. A. Harris, writing in the *Indian Medical Gazette*, says: "The further experience I have gained in Calcutta, especially at the Medical College, during the past ten years, has convinced me that tubercle in one form or another is one of the most common and fatal diseases in this city, and my impression further is that it is not decreasing, if it is not actually on the increase, especially amongst Indians."

Vital statistics for many countries in the Tropics are not to be had, but the following figures culled from various sources show a crude death rate from tuberculosis in several tropical cities:

	Death Rate per 1000.
Honolulu, I. T.....	3.26
Kingston, Jamaica.....	3.40
Rio de Janeiro, Brazil.....	3.80
Port of Spain, Trinidad.....	4.75
Caracas, Venezuela.....	5.80

At the hospital of the United Fruit Company, at Bocas del Toro, Panama, during the year 1912 there were 45 deaths amongst employees; 13 of them were caused by tuberculosis, which is 28% of the deaths. In Bogota, Colombia, with an elevation of 8,760 feet, tuberculosis causes 12% of the deaths, and in Barranquilla, in the same country, it causes 16% of the deaths.

Tuberculosis amongst cattle and hogs in the Tropics is, as far as I am able to learn, very rare. According to Gerhart (*Manila Medical Bulletin*, Vol. 1, p. 6), there were 60,000 hogs, and 30,000 cattle, killed in Manila during the year 1909, and none of them were tubercular. Of 94,000 hogs slaughtered in Parak, Selangor and Penang during 1908 and 1909, none were tubercular. The number of tubercular cattle in Honolulu is increasing, but the percentage is still very small.

The situation in the Tropics, then, appears to be that tuberculosis causes a great mortality amongst human beings, but very few animals suffer from it. The cause must be that the human beings are housed during the night in buildings in which there is no ventilation and the animals live in the open air all the year round.

My observations in the Tropics cause me to believe that the predisposing causes of tuberculosis there are the same as in temperate regions, but that certain of them are of greater importance. Industrial causes are negligible, but I believe that the mosquito is the greatest predisposing cause. Not that mosquitoes can transmit the disease. The native dreads malaria, and has learned that by keeping his house closed up tightly after dark his family will suffer less from fever. We therefore find that very little fresh air is admitted to the sleeping apartments during the night. I once counted the number of houses with windows open during the night in the City of Manila, and found about

25% had windows open. This was during the dry season, and without doubt during the rains the number would be much less. To appreciate the foul condition of the air in a native house one has but to make a visit after the family has retired. He will gain information at first hand that will make him appreciate the necessity of having an ample supply of fresh air in the sleeping apartments, despite the theoretical arguments to the contrary.

Just so long as a tropical city is infested with mosquitoes, just so long will the incidence of tuberculosis be high.

There are many who will grant all of the above, but will ask what is to be done about it. They will look on the dark side and say that nothing can be accomplished with native people. In those portions of the Tropics that are under the American flag a great deal can be accomplished by a campaign of education. The Filipino especially is anxious to learn, and if properly instructed, the next generation will make great strides towards hygienic living.

For the benefit of those who are pessimistic we have but to recall the results obtained by that master of sanitarians, Gen. W. C. Gorgas, in the Canal Zone, where the incidence of tuberculosis has been greatly reduced. In 1905 the rate charged to tuberculosis was 5.23 per thousand, while in 1910 it was but 3.93, a reduction of 25%.

While it is not desirable to detract from the enthusiastic study of those diseases which are peculiar to the Tropics, it seems that if the health officials are to accomplish the "greatest good to the greatest number" they must devote more time and funds to the prevention of tuberculosis.

"MAL DE BOCA."

By

NATHAN BARLOW, M. D.,
Cuyamel, Honduras.

Tropical infectious stomatitis is recognized by the natives of Central America as a definite clinical entity, under the name of "mal de boca." The natives are acquainted with its contagious nature, and will often state that they contracted it from using the same spoon or drinking glass as one already infected.

The writer became familiar with the disease in Northern Mexico, where it has a wide range. Cases have been seen by Dr. R. M. Frazeur and the writer from all parts of Honduras, Nicaragua, Guatemala, Salvador, and Panama. The writer has seen the disease in a Mexican in Houston, Texas, and in a Guatemalan who undoubtedly contracted it in New Orleans, Louisiana.

Etiology.

The disease is transmitted by direct or indirect contact with one already infected. All persons are susceptible, but the more severe forms usually develop in those already debilitated. All forms of cocci, bacilli, and spirochætæ are usually present. There is no fungus which is frequently present. The writer regards a rather delicate spirochæte as the most probable cause.

Symptoms.

The gums are usually first involved in the neighborhood of the incisors. They are swollen, spongy, and very tender. Soon a whitish pellicle forms over the involved area, especially marked at the edge of the gums, where it may give the appearance of a purulent exudate. There is, however, but little secretion from the lesions—the saliva always flows abundantly. The process extends superficially much more rapidly than in depth, often attacks the cheeks and lips at the points of contact, and in advanced cases may involve the hard and soft palate, and even

the tonsils. The pellicle separates later, leaving an eroded surface, which very gradually deepens. The roots of the teeth may be exposed, but the periosteum is never attacked. In advanced cases there is great debility from pain and lack of nutrition from inability to eat. There are no other constitutional symptoms. The lymphatic glands of the neck are enlarged.

Diagnosis.

From Riggs' disease by the rapid development, painful character, superficial extension, and absence of pockets of pus. From syphilis by the greater pain, swollen and spongy character of the edges of the patches, and the localization of the lesions at the alveolar margins. The presence or absence of other signs of lues should not be considered, as both Dr. Frazeur and the writer have several times made the diagnosis in patients who have also had active syphilis, and in whom an active anti-syphilitic treatment has, as usual, aggravated the condition. At a certain stage the disease would almost certainly be mistaken for mucous patches by one not familiar with it; but the serious error of informing an innocent patient that he was a victim of lues would probably be corrected by the invariable exacerbation under mercury or iodid, and by the fact that salvarsan exerts no influence. Mercurial stomatitis is not so superficial nor so painful in proportion to the extent of the lesion, affects the periosteum and bone, and is accompanied by more profuse salivation. Noma is easily distinguished by the fetor and by its rapid destruction of tissue. Sprue and scurvy would scarcely be confounded with "mal de boca," on account of their constitutional symptoms. Thrush is easily distinguished by its more general distribution, its firmer and whiter plaques, absence of pain, and by the presence of the characteristic fungus.

The advanced form which has invaded the palate and tonsils bears some resemblance to tuberculosis, but may be distinguished by the absence of nodules, by its more superficial character, and its invariably yielding to the treatment described below.

Prognosis.

The mild and moderately severe forms ultimately recover if left to themselves, but are likely to be followed by pyorrhoea alveolaris or caries, from exposure of the roots of the teeth. The severe form is capable of persisting indefinitely, and produces great debility from pain and inability to eat. The process is not a purulent one, and neither Dr. Frazeur nor the writer have ever seen any other complications.

Treatment.

The milder forms yield readily to cleanliness and antiseptic mouth washes, or to the application of tincture of iodine. These measures only irritate the severe cases. The only treatment which either Dr. Frazeur or the writer has found effective in these cases is the frequent painting of the entire affected area with a strong solution of one of the organic silver preparations—for example: 5% protargol, or 40% argyrol, application to be made every hour. Internal remedies are useless. Mercury or iodids aggravate the condition.

The writer wishes to acknowledge the kind assistance of R. M. Frazeur, D. D. S., of Puerto Cortes.

NEWS AND COMMENT

In James county, Tennessee, 75 out of 100 children examined were found to have hookworm.

In the rat campaign in Philadelphia, two rats infected with leprosy germs have been brought to the station.

Dr. George Dock has moved from 1806 Locust street and is now located at 611 West Jefferson avenue, St. Louis, Mo.

Russia is contemplating the establishment of a cholera service. It is reported that the dread disease has already appeared in the army.

All teachers in Springfield, Ill., must be examined and receive certificates of good health before being given positions in the public schools of the city.

Texas is to have a health exhibit car. The Legislature has appropriated \$10,000 for the purpose. The car will start out this month and will carry a director and several lecturers.

Dr. Henry J. Nichols, U. S. A., will be relieved from duty at the Army Medical School and will go to the Letterman General Hospital, Presidio of San Francisco, Cal.

The death rate for Porto Rico last year was 18.6 per thousand, a decrease of 5832 deaths annually since 1911, the year in which the Public Health Service was established.

Senior Surgeon H. R. Carter, U. S. P. H. S., Baltimore, has been instructed to go to Bluett Falls, on the Peedee river, in connection with malarial investigations in North Carolina.

Pellagra patients will not be treated at the Vicksburg Emergency Hospital, as the trustees contend there are not proper facilities in the hospital for the treatment of such cases.

The Pan-American Congress of University Students, to have been held in Santiago, has been indefinitely postponed on account of the unsettled financial conditions due to the war.

According to a report of Miss Annie Nason, superintendent of the Nathan Straus Laboratories, 2,148,119 bottles of milk were distributed from the eighteen stations during the past year.

Antityphoid vaccination is not compulsory in the English army, but the Army Medical Department is much in favor of it and strongly desires the power to require all soldiers and others to be inoculated.

The hookworm campaign carried on in Jones county, Mississippi, was completed the latter part of August. Over 25,000 cases were treated. In many schools, all of the teachers and pupils were found to be infected.

Dr. Joseph Goldberger, U. S. P. H. S., has been directed to proceed to Morris Plains, N. J., for the purpose of collecting data relative to the diet of patients in the State Hospital and its effect upon pellagra and scurvy.

At the request of the Minister of Militia, Dr. George G. Na-smith, bacteriologist of the Toronto Board of Health, will go to Europe to supervise the water supply and other matters of sanitation for the English soldiers.

Dr. W. H. Seemann has been elected dean of the Tulane School of Hygiene and Tropical Medicine, New Orleans. Besides the regular courses in tropical medicine and hygiene, special courses for health officers will be afforded.

Surgeon R. H. von Ezdorf, Assistant Surgeon Robert C. Derivaux and Sanitary Engineer J. A. Lee Prince, U. S. P.

H. S., have been delegated to investigate the spread of malaria in Greenville, Miss., and large plantations in Washington county.

Naturally the publication of foreign medical magazines has been seriously interfered with by the war. Several French and German periodicals have abandoned an attempt at publication, while others appear irregularly in a much abbreviated form.

A rat-receiving station has been opened at the Race street pier, Philadelphia, and a bounty will be paid for all rats brought in dead or alive. Ships landing in Philadelphia are rigorously inspected and all rats taken therefrom are inspected for bubonic plague.

The Safety Congress of Mayors will meet in New York City Dec. 14 and 15, and special invitations to attend have been sent all mayors of towns of over 25,000 population. The congress will discuss matters of safety, public health and sanitation and welfare.

In collaboration with Dr. Edmund Moss, medical inspector of the public schools of New Orleans, the faculty of the Tulane College of Medicine has begun a systematic examination of the New Orleans school children to ascertain the presence of communicable and infectious diseases.

The Health Train of the Louisiana State Board of Health has just returned from a fourteen-day trip through the State. Accompanying Dr. Dowling and the regular force were Dr. C. C. Bass and Mr. W. B. Terhune. Lectures illustrated by moving pictures were given at the different stops.

The safety idea seems to be replacing the clean-up campaigns of spring and summer. This does not mean simply the prevention of accidents, but includes matters of hygiene and sanitation as well. Such a convention has recently been held in Philadelphia by the Home and School League.

The food and sanitary conditions of Paris are said to be fair. Vaccination bureaus have been established and all those not

having been vaccinated within the last five years are urged to go to one of these. Warnings have also been sent out that garbage should be burned and water boiled.

The Wisconsin State Hygienic Laboratory has been enlarged and now occupies the entire top floor of the south hall of the university. The laboratory is maintained out of university funds and is under the immediate charge of Dr. W. D. Stovall, chief bacteriologist, and E. J. Tully, chief chemist.

It is reported that professors of the German universities will follow the example of the Emperor and renounce all honors and degrees bestowed upon them by British scientific societies and universities. The gold medal given to Prof. Röntgen for his discovery of the X-rays by the Royal Society has been given by him to the German Red Cross to be melted.

A milk distributing depot is being erected in New Orleans by Mr. George H. Appel and will be under the direction of the New Orleans Pure Milk Society, of which Dr. L. R. DeBuys is president and Dr. Herbert M. Shilstone is bacteriologist and sanitarian. The purpose of this depot is to increase the supply of pure milk in New Orleans, to regulate the certified dairies and to concentrate the delivery of the inspected milk.

The annual meeting of the American Public Health Association will be held in Jacksonville, Fla., from Nov. 30 to Dec. 5. This is the first meeting of the association to be held in one of the Southern Atlantic States. It is planned to gather together material of special interest in the South, such as hookworm, malaria, pellagra, etc., and hold an exhibit to be known as the Southern Health Exhibit; bubonic plague will also be given an important place.

With the death of one plague victim, an aged negress, the latter part of September, and the discharge of the one other case at the Isolation Hospital, human plague cases do not at present exist in New Orleans. The last death was the ninth fatal case and was far advanced when taken to the hospital.

There have been twenty-nine cases in all. Rodent cases, however, continue, the total being 177. Rat-proofing is being done in all parts of the city and the same stringent rules for the inspection of all outgoing freight hold. The city laboratory space has been found insufficient, and an additional laboratory has been opened by the Board of Health on the roof of the City Hall Annex.

Public Health Activity.

CONNECTICUT.—(Monthly Bulletin of the State Board of Health, August, 1914.)—The Children's Bureau of the Department of Labor, under the direction of Miss Julia C. Lathrop, has entered into a coöperative movement with the women's clubs of different cities to check the accuracy of birth registration. The plan is for the members of the organizations in the different cities chosen to each get the names of probably ten babies, go to the registration office to see if they are properly registered and report the results to the Children's Bureau.

NEW YORK.—(Weekly Bulletin of the New York City Department of Health, Aug. 29, 1914.)—A little sentence which we wish to repeat caught our eye in this bulletin: "Truly our changed point of view denotes progress. Once cleanliness was a virtue; now the lack of it is a crime."

NEW YORK.—(*Buffalo Sanitary Bulletin*, Aug. 31, 1914.)—Instead of the usual baby contest, a Better Mothers' Contest is being arranged by the Buffalo Department of Health. The prize will be given the mother, who will be judged for the care given the baby. The mothers whose children receive a score of 85 will be awarded a certificate of proficient motherhood.

OHIO.—(*Toledo Sanitary Bulletin*, September, 1914.)—Large quantities of dried fruits, raisins, currents, candy and other foods are found unfit for use and condemned. The law requires all such food to be destroyed, but jobbers in foodstuffs want the food to be left with the dealers, to be returned by them to the jobbers, who in turn will exchange them with the manufacturers

for fresh goods. It has been found, however, that when this is done the candy is often reboiled and made into fudge to be put in "grabbags" for little children. The other food is renovated and returned for public use as new.

VIRGINIA.—(*Health Bulletin*, September, 1914.)—This bulletin contains a short catechism on malaria. The text is based on a more elaborate paper prepared by Dr. H. R. Carter, senior surgeon U. S. P. H. S. The pamphlet sets forth thoroughly, though in a simple manner easily understood by the school children for whom it is intended, the principal facts relative to malaria; how the disease is carried; where the mosquitoes breed and the difference between malarial and nonmalarial mosquitoes; methods of eradication; treatment of the disease, etc. As said before, the paper is thorough and concise and should be a long step toward the final eradication of malaria in Virginia.

ERRATA.

In the article on "The Relationship of the Renal Lesions of Asiatic Cholera to the Ordinary Nephritides With Especial Reference to Acidosis," in the August number of the Journal, Dr. A. W. Sellards, the author, requests the following changes and corrections noted.

On page 113, eleven lines from the bottom, to read "Wherry has suggested an intensive alkaline therapy, consisting of the use of 14 grams of sodium chlorid and ten grams normal sodium carbonate in a liter of water." (The original read 10 grams of sodium chlorid and twenty grams of sodium carbonate.)

The following *references* should read as corrected:

1. Müller, Verhandl. d. Deutsch. Path. Gesellsch. 1905, IX, 64.
13. Emmerich and Jusbaschian. *Arch. f. Hyg.*, 1912, LXXVI, 12.

CURRENT LITERATURE

THE COASTAL CLIMATE OF TROPICAL QUEENSLAND; METEOROLOGICAL OBSERVATIONS TAKEN AT TOWNSVILLE.—(*Jour. Trop. Med.*, 1914, XVII, 225). Taylor and Young find, as a result of daily observations taken at the Australian Institute of Tropical Medicine, Townsville, North Queensland, that there are two distinct seasons, each of six months' duration; a cooler season commencing toward the end of April; and a hotter season toward the end of October. Simultaneously with the fall of temperature observed during the last of April and the first of May, there is a similar decrease in the relative humidity of the air. The wet season finishes about the end of April; only light rains occurring in May and June; to the extent of 1.64 and 0.54 inches respectively. From the first of July until the middle of September only 0.32 inch of rain was registered. During the last of October and the first of November there is a marked rise in the temperature, with an increase in the relative humidity when the rains begin. From the first of December until the end of April, 45.59 inches of rain were registered. Observations were also made concerning the intensity of sunlight, as regards the violet and ultra-violet rays after the method originally described by Paul Freer of the Bureau of Science, Manila. This method depends upon the photocatalytic decomposition of oxalic acid into carbon monoxid, carbon dioxid and water in the presence of a uranium salt. The sunlight in Townsville is found by this method to be extremely rich in violet and ultra-violet rays. The maximum decomposition was 22%, which is higher than any other observation, whilst the average decomposition is higher than that recorded at Kuala Lumpur, a place almost on the Equator. There is no difference as regards the maximum intensity of these rays between the hot and the cold seasons, and that the lower averages which are obtained during the hot wet season are really due to the fact that the sun is obscured by clouds.

John M. Swan.

PRELIMINARY NOTES ON ENTAMEBIASIS.—(*Jour. Trop. Med.*, 1914, XVII, 227). As the result of a systematic examination of the stools of all cases of fever, which were not amenable to quinin and were not typical of enteric fever, Lim Boon Keng found that infection with entamebae is quite a common disease in Singapore. The disease is polymorphous to such an extent that the author is inclined to rank it in that respect with syphilis. The infecting organism, according to his experience, is the *Entameba histolytica*, or some form closely allied to it. The primary infection is usually by way of the intestinal canal, when it produces the well-known amebic dysentery. It may be located in the bile passages, however, without giving rise to intestinal symptoms; but producing nausea, vomiting and epigastric pain. This hepatic infection is often characterized by an irregular fever and is frequently diagnosed typho-malaria. It should be called entamebic fever. Very soon after it starts flatulence and diarrhea occur and then the condition may be mistaken for typhoid fever. The urine may show the diazo-reaction. Sometimes the hepatic infection is very acute and produces toxemia. More rarely multiple abscesses may be the first indication of the illness. Hepatitis and hepatic abscess is a late manifestation of the disease. He gives the following table of the protean features of the disease:

Primary manifestations: (1) Hepatic passages; toxemia, entamebic fever, enterocolitis. (2) Intestinal canal; acute amebic dysentery. Secondary manifestations: (1) Skin; urticaria, bullous eruption, ulcers, multiple abscesses. (2) Chronic bronchitis. (3) Hepatitis and hepatic abscess; obscure headaches, neuralgic pains. (4) Entamebic cachexia; anemia, anasarca, albuminuria, profuse sweats, debility. (5) Peritonitis, ascites, typhlitis (?). Relapses are very frequent and one form of the disease may pass into another. Death may result from hyperpyrexia, exhaustion, asthenia or cachexia. The only remedy is emetine chlorid. The maximum dose should be given either subcutaneously, intramuscularly or intravenously.

J. M. S.

A STUDY OF THE NITROGENOUS METABOLISM IN CHYLURIA, W. J. Young (*Jour. Trop. Med.*, 1914, XVII, 241) reports two

cases of chyluria in which the urine always contained fat which could be extracted with ether. A twenty-four-hour specimen in one case contained 1.8%, and in the second case 2.6% of fat. The urine also contained a quantity of protein which showed the properties of the proteins of the lymph. The microscopic examination showed leukocytes, red blood corpuscles, epithelial cells and crystals, in one case; and red and white corpuscles and granules in the second case. Neither specimen contained sugar. In one case a complete analysis of the nitrogenous constituents of the urine was made daily for a period of fourteen days. The patient received a diet in which the nitrogen content was approximately 15 grams. The quantity of protein nitrogen excreted per day varied from 0.49 gram to 1.94 gram, the average for the fourteen days being 0.95 gram. This is a very low grade of nitrogenous metabolism. The average urea content during this period was 69.4%, ammonia 6.6%, creatinine 5.4%, uric acid 2.2%, and an undetermined factor 16.9%. The nonprotein nitrogen actually used in metabolism was very small in quantity, the average being 6.39 grams, representing approximately 40 grams of protein catabolized. In the second case the patient was maintained on a diet containing 15.4 grams of nitrogen for 8 days; and on the succeeding days a diet of eggs, milk, bread and butter was given, the quantity of which was uncontrolled. During the first period the average total nitrogen excretion was 14.38 grams per twenty-four hours. The average protein nitrogen excretion was 2.49 grams, the average non-protein was 11.89 grams. The average creatinine and creatine percentage of the nonprotein nitrogen was 4.6. During the second period the average total nitrogen excretion was 10.17 grams, protein nitrogen 2.27 grams, nonprotein nitrogen 7.90 grams. The average creatinine and creatine percentage of the nonprotein nitrogen was 6.1.

J. M. S.

FURTHER NOTES ON ENTAMEBIASIS.—Dr. Lim Boon Keng (*Jour. Trop. Med.*, 1914, XVII, 244) says that, as a result of his observations, rheumatic inflammations and rheumatism, as seen in Singapore, are associated with a protozoon organism found in the intestinal canal. The organism found is, as near as he can determine, a mycetozoon and is a form of chlamydo-

mysca. Provisionally he calls it *Chlamydosporia taxifera*. He describes the life cycle of the organism as consisting, first, of a funguslike plasmodium with very few free amebæ in the feces, and granular amebæ in the sputum and in the blood; second, of a multiplicative stage consisting of large granular amebæ undergoing fission, schizogamy and budding by means of chromidia shedding; third, of the encysted stage; fourth, of parasites in all stages found in the blood and affecting the kidneys.

J. M. S.

1. COLLECTED STUDIES ON THE INSECT TRANSMISSION OF TRY-PANOSOMA EVANSI. II. SUMMARY OF EXPERIMENTS IN THE TRANSMISSION OF ANTHRAX BY BITING FLIES.—(Hygienic Laboratory Bulletin No. 94, June, 1914.) M. Bruin Mitzmain reports successful results in the mechanical or direct transmission of surra by means of *Tabanus striatus*, the common horsefly of the Philippines, and under less natural conditions by *Philaematomyia crassirostris* and *Musca domestica*. Negative results were obtained with two species of mosquitoes, *Aedes calopus* and *Culex fatigans* and with *Lyperosia exigua*, *Hippobosca maculata* and *Culicoides judicandus*. With *T. striatus* it was found that one fly was capable of producing infections by the interrupted feeding method. Fifteen minutes after the infected meal was the greatest interval in which infection resulted. It appears that no cycle of development occurs in this fly and hereditary transmission of the trypanosome was disproven.

In the second paper successful experiments in the mechanical transmission of anthrax by means of *Stomoxys calcitrans* and *Tabanus striatus* are reported. *S. calcitrans* in lots of 12 and 15 individuals fed first on an infected guinea pig, shortly before its death from anthrax, and immediately transferred to healthy animals produced positive infection. Eighteen experiments resulted negatively with *Stomoxys* in lots of 1 to 12 when fed on horses, bulls and guinea pigs several hours prior to death. It is not clear why these tests all proved negative, as five further experiments with the stable fly and three with the horsefly, in which the infected host was first proven to contain *B. anthracis* in the peripheral circulation, were all positive. The greatest interval between the infective feed and the biting of the healthy

host in which transmission was successful was 20 minutes. Living and virulent anthrax organisms were recovered uniformly from the feces of individuals of both species of flies up to the ninth day after engorgement on anthrax-infected blood, but none of the healthy animals bitten during this time became inoculated.

W. V. King.

THE DESTRUCTION OF THE VITALITY OF CYSTICERCUS BOVIS BY FREEZING.—(*The Journal of Parasitology*, Vol. 1, No. 1, September, 1914). B. H. Ransom reports on experiments undertaken to determine the minimum length of time that beef carcasses infested with cysticerci need be refrigerated to result in the destruction of all parasites. He determined that six days at a temperature of 15° F. (—9.440) was a safe margin, and that the cysticerci were all dead or much weakened on the fifth day. On the basis of these results, an amendment to the Federal meat inspection regulation was issued which recognizes a six-day period at 15° F. as an alternative to the previous requirement of retention for twenty-one days at ordinary refrigerator temperature.

SUMMARY OF TWO YEARS' STUDY OF INSECTS IN RELATION TO PELLAGRA.—(*Ibid.*). A. H. Jennings reviews the investigations carried on in 1912 and 1913 by W. V. King and himself in coöperation with the Thompson-McFadden Pellagra Commission. On nonexperimental evidence, practically all biting insects, including the genus *Simulium*, seem to be eliminated as possible transmitters of pellagra, excepting the stablefly, *Stomoxys calcitrans*. On the other hand, if pellagra is found to be an intestinal disease of bacterial origin, houseflies and others of similar origin will in all probability be found to be active in its spread.

VARIATION IN OXYURIAS: ITS BEARING ON THE VALUE OF A NEMATODE FORMULA.—(*Ibid.*) S. B. Fracker contributes a study of the value of Cobb's "nematode formula" when applied to the classification of parasitic Nematoda. The conclusions cannot be quoted here, but in the author's opinion after a careful study of the variations in *O. vermicularis* "a species should not be described as new on account of a deviation from the proportions of known species unless that deviation is great and fundamental" and has been determined for several individuals.

OBSERVATIONS ON THE EGGS OF ASCARIS LUMBRICOIDES.—(*Ibid.*) W. D. Foster discusses the finding of extremely atypical forms of eggs of nematode.

RHABDITIN.—(*Ibid.*) N. A. Cobb contributes a study of "an organic substance, the type form of which is found crystallized in brilliantly double refractive spheres arranged in a definite way in the cells of the intestine of *Rhabditis monhystera* Bütschli, and other nematodes in whose metabolism it plays an important rôle." The tests made indicate that the substance is a carbohydrate.

EXPERIMENTAL INGESTION BY MAN OF CYSTICERCI OF CARNIVORE TAPEWORMS.—(*Ibid.*) M. C. Hall here reviews the literature on the subject and cites experiments on himself which go to disprove the frequently quoted record of *T. pisiformis* from man. His own experiences confirm the generally accepted view that adult cestodes of genus *Taenia*, which occur in carnivores, do not occur in man.

A PECULIAR MORPHOLOGIC DEVELOPMENT OF AN EGG OF THE GENUS TROPICAL AND ITS PROBABLE SIGNIFICANCE.—(*Ibid.*) W. D. Foster describes peculiar filiform appendages found present on the eggs of a species of *Tropidocerca* from an American woodcock. Eggs of this nature are apparently very rare among the species of this genus.

THE ACTION OF ARSENICAL DIPS IN PREVENTING TICK INFECTION.—(*Ibid.*) H. W. Graybill has previously determined that cattle dipped in an arsenical dip are protected for two full days from infestation with cattle ticks in the larval stage. In the experiments reported here, it was found that cattle dipped once in an arsenical dip (containing sodium arsenite equivalent to 0.1863% As_2O_3) were not protected from infestation when ticks were applied three and four days after dipping, but that the degree of infestation was markedly lowered. W. V. K.

TRYPANOSOMIC INTERMITTENT FEVER RESISTANT TO ATOXYL.—(*Le Progrès Médical*, July 11, 1914.) At a meeting of the Société médicale des hôpitaux, Drs. Martin, Darré and Dumas reported a case of sleeping sickness which was interesting both from a clinical and a therapeutic point of view. Clinically, the disease showed itself exclusively by an intermittent fever

of almost periodic regularity, simulating intermittent malarial fever, but differing from it by the long intervals between paroxysms (eight to ten days), by the absence of the plasmodium of Laveran, and by the presence of numerous trypanosomes in the blood taken during the first hours of a febrile attack. This fever should be regarded as a trypanolytic fever, due chiefly to the massive destruction of the parasites under the influence of the anti-bodies contained in the blood. The disease was caused by an atoxyl-resistant trypanosome, as was shown by clinical observation and experimental study of the parasite. The exhibition of very large doses of atoxyl did seem to cause a brief truce in the combat, but in order to triumph definitely it was necessary to have recourse to tartar emetic in combination with atoxyl. The chemo-therapeutic study of sleeping sickness, which is easily made by direct observation of the patient as well as by experimental inoculations, show how different specimens of a parasite can be differently influenced by the same parasiticide; the majority are destroyed by relatively small doses, others require larger doses to destroy them, still others are only temporarily influenced by the largest doses tolerated by the infected organism and can only be destroyed by more powerful parasiticides. Thus there exist varying degrees of resistance in the different strains of various specimens of parasites, to the action of a given remedy.

A. McShane.

THE SECRETION OF UROBILIN IN MALARIA, ESPECIALLY IN BLACKWATER FEVER.—(*Archiv fur Schiffs und Tropen Hygiene*, Heft, 5, 1914). Dr. N. Sörensen, military surgeon in the Dutch East Indies, reports the results of numerous observations on the secretion of urobilin in malaria patients in the Island of Flores. This island consists predominantly of high, steep, volcanic mountains with deep clefts and precipices. There are scarcely any plains and almost no swampy lands at all. Stagnant water is very rarely found. Gnats are numerous, but very small day mosquitoes (among them *Stegomyia*) abound, and only a few *Anopheles*. Notwithstanding this, this island, compared with other Dutch East Indian islands, is overrun with malaria. Tropical and quartan fevers are perhaps equally frequent; tertian is rarer.

For the urobilin reaction, the Schlesinger test was usually employed; first, a saturated solution of acetate of zinc in absolute alcohol, and, second, an aqueous solution of iodine and iodide of potassium (1:2:50). A measured quantity of urine is added to an equal quantity of the zinc acetate solution and vigorously shaken; then a few drops of the iodine solution are added and if hemoglobin be present it is precipitated and urobilinogen is oxidized into urobilin. The mixture is filtered after five minutes. If urobilin be present, there is a green fluorescence in the filtrate. The filtrate may be more closely examined with the spectroscope. There is an absorption-band between the lines E and F, and, with greater concentration, a darkening of the entire blue part of the spectrum.

In all of the cases examined, there was a distinctly positive reaction and equally so in tropica, quartana and tertiana. A few days (2 to 4) after the subsidence of the fever, the reaction was either negative or showed only a trace. In approaching relapses, Dr. Sørensen saw in several cases (including himself) the reaction return and daily increase in distinctness. In other cases, the reaction was entirely absent, because they had relapses without a preceding increase of urobilin. In the troops on a certain expedition, the reaction was very variable; but even here valuable information could be obtained, for the patients with a large percentage of urobilin felt sicker, became more anemic, and convalesced more slowly than those that presented a feeble reaction. One morning, he was surprised to find a high percentage in a man who, for several days, had had a mild fever of the ambulatory type, and had taken one gram of quinine in the morning for a day or two. Jaundice was present, but was only discovered after a large urobilin percentage in the urine, but no hemoglobin. Dr. Sørensen reasoned that, if the excretion of urobilin stood chiefly in relation to the destruction of the red blood corpuscles, such a large percentage as the patient showed would justify in fearing an attack of blackwater fever. The patient took no more quinine and was hospitalized. All the urine was preserved. During the night hemoglobin first appeared in the urine, increasing in quantity until midday, and not disappearing for about forty hours; for several days after that, there was still a high

urobilin percentage. In a week the urine became normal, and the patient felt well in ten days. In a short time Sørensen observed fifteen other cases of blackwater fever. They were, without exception, diagnosed as "suspicious" of being blackwater fever half a day or a day before the appearance of the hemoglobinuria. It soon struck him that all the patients had still had fever even after they had taken two doses of quinin of one gram each. He carefully examined the urobilin percentage of such cases. Some had a moderate amount; there were still kept on quinin and with such good effect that the fever ceased after the third dose, unless complications set in. When the reaction was more marked, no more quinin was administered; they all had hemoglobinuria in from ten to twenty hours after the second dose, and lasted for from twelve to thirty-six hours. All of the sixteen patients recovered. Most striking was the mild course of the hemoglobinuric attack. The patients all had perceptible icterus and felt very sick and weak, but they rested well in bed, did not vomit and could take cold drinks; no danger to life was ever apprehended. When, however, another dose of quinin, even after the occurrence of the hemoglobinuria—and this was usually the case without an estimation of the urobilin—was given, the course of the disease was quite different. In this connection the following case may be cited: A patient who had blackwater fever three days before Sørensen's spectroscope arrived (and who is not included in the sixteen cases reported) took one gram of quinin every morning. At 11 o'clock one morning a severe attack of blackwater fever came on and in about three hours the patient became comatose and died at 5 p. m.

McS.

PROTOZOA OF THE MOUTH IN RELATION TO PYORRHEA ALVEOLARIS.—(M. J. Barrett, D. D. S., *Dental Cosmos*, August, 1914). In collaboration with Allen J. Smith, Barrett presents studies of Rigg's disease, with suggestions for treatment, and gives three case histories in point with treatment suggested. Such etiological factors as the presence of tartar on the teeth, of anemias, gout, diabetes, syphilis and Bright's disease are recalled and the vegetable microorganisms found in the mouth are discussed. In forty-six cases examined, parasitic amebæ were found, but the

endameba remained unidentified, though Smith and Barrett suspected two different species. Several forms of amebæ have been described in the mouth, *Endameba Kartulisi*, *Endameba buccalis* (of Prowazek, probably the same as the *E. buccalis* of Sternberg). The cases examined were found to harbor the endamebæ in the pyorrhea pockets, actively moving. The investigators express a concurrence in the statement of A. D. Black (*Dental Cosmos*, June, 1912) that "95% of persons who apply regularly for dental service have present in their mouths in some location conditions which constitute the principal etiological factors of periodental inflammation." In normal cases used for control, critical examination disclosed in three of ten endamebæ in alveolar pockets. Emetine is suggested in the treatment of these cases. L. Rogers, in Calcutta, in 1912, first suggested this remedy as an amebicide and it has been extensively used for amebic conditions in the bowels. The present paper submits the use of emetine locally in twelve of thirteen cases. A 1% solution at first proved too irritating and was replaced by a one-half of 1% solution of emetine hydrochlorid. The needle carrying the solution is forced down into the pockets, the point passing directly into the wall of the pocket, and as it is withdrawn each pocket is left filled with the solution. In several of these thirteen cases the pus disappeared completely on gross inspection in 24 hours after application; in all, this result was obtained and in all cases treated after the second or third injection the general tissue took on a healthier appearance, the teeth were firmer and the gums harder. After the second or third treatment the endamebæ have not been found. The three cases instanced give the detail of the treatment and in each the clinical results were confirmed by bacteriological support.

The conclusions point to a specific ameba of pathogenic type as more or less responsible and that emetine, given as in amebic dysentery, should be further tested in pyorrhea alveolaris. The presence of other protozoa—at least one flagellate and probably a ciliate—should be considered.

Dyer.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

PRACTICAL SANITATION. A Handbook for Health Officers and Practitioners of Medicine, by Fletcher Gardner, M. D., and James Persons Simonds, B. A., M. D. C. V. Mosby Company, St. Louis, 1914.

ATMOSPHERIC AIR IN RELATION TO TUBERCULOSIS, by Guy Hindale. Smithsonian Miscellaneous Collections, Vol. 63, No. 1. Published by the Smithsonian Institution, Washington, D. C., 1914.

Boletim de Sociedade Brasileira de Dermatologia, Nos. 2 and 3, 1913.

Report of the Bureau of Health for the Philippine Islands. July 1, 1913, to Dec. 31, 1913. Victor G. Heiser, Director of Health, Manila, 1914.

BOOK REVIEWS

CLINICAL HEMATOLOGY AS AN INTRODUCTION TO THE CLINICAL STUDY OF THE SO-CALLED BLOOD DISEASES AND OF ALLIED DISORDERS. By Gordon R. Ward, M. D., Philadelphia. W. B. Saunders Company, 1914.

This is a thorough discussion of clinical hematology. The diseases of the blood, or as the author very correctly says, the diseases of the blood making organs, are discussed from every standpoint and such of treatment as is now available is also given. One valuable part of the work is a new and original classification of blood diseases. If this classification finally meets with approval and adoption, it will fill a long felt want.

C. C. Bass.

PRACTICAL SANITATION, Garner and Simonds. "Hygiene is the science through which the practical application of which public and personal health may be secured," says J. N. Hurty, who writes the introduction to this book. The book presents the detail of the application.

Inspection, epidemiology, isolation and quarantine, disinfection and the management of individual diseases involved are all presented and well discussed. Chapters are given over to the diseases which have fallen within sanitary practice, and the particular obligations of the health officer are detailed, with practical instructions in the care of the patient and his surroundings, from the health point of view. In some diseases ideas on preventive medicine and immunity are also ventured. All of the diseases discussed are grouped according to accepted classification.

Under the general division of sanitation the authors devote considerable space to the duties applying to the health office, in which records, surveys, milk, food and water inspection, sewage disposal and community cleanliness all find place.

A final chapter takes up the laboratory side of public health work, and an appendix gives an outline of a general sanitary survey.

The book is practical throughout and should serve an excellent purpose for every-day instruction in a needed field. Dyer.

REPRINTS.

BARRETT, M. T. The Protozoa of the Mouth in Relation to Pyorrhea Alveolaris. Reprinted from the *Dental Cosmos*, August, 1914.

FITZPATRICK, GILBERT. A Study of Factors in Parturition. Address of the president of the Obstetrical Society, A. I. H., Atlantic City, June 29, 1914.

Government of the Philippine Islands. Disposal of Human Wastes in the Provinces. Health Bulletin No. 13, March, 1914.

HOLT, JOHN M. Emetin in Amebic Dysentery. Reprint No. 212 from the Public Health Reports, July 31, 1914.

MITZMAIN, M. BRUIN. I. Collected Studies on the Insect Transmission of *Trypanosoma evansi*. II. Summary of Experiments in the Transmission of Anthrax by Biting Flies. Hygienic Laboratory, U. S. P. H. S., Bulletin No. 94, June, 1914.

RUCKER, W. C. The Administration of a Yellow Fever Campaign. Supplement No. 15 to the Public Health Reports, June 12, 1914.

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CHARLES CHASSAIGNAC, M. D.

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EDITORIAL

The Treatment of Leprosy.—We are probably to find the specific treatment for leprosy some day; as yet no glimpse has been given of such a desideratum. It is none the less gratifying to note the experimental work of Heiser and his co-workers in the Philippines producing such favorable results. It is a step forward if, by smaller dosage, at less tax upon the patient, chaulmoogra oil may be administered hypodermatically and in a mixture which is more or less free of pain. The formula should be tried out wherever leprosy occurs in sufficient numbers to justify conclusions.

As long ago as 1888, Blanc used chaulmoogra oil by needle in the wards of the New Orleans Charity Hospital, but the results did not appear to justify a continuance of the experiment; the addition of camphor and resorcin, as used by Heiser, would seem to have made the oil more effective in the Philippines.

What part the resorcin alone might play in the curative process has not been discussed by Heiser, but it should be used as a control to determine whether the chaulmoogra oil can be wholly credited with the results obtained.

Most cases of leprosy of cutaneous type, uncomplicated by trophic changes, will respond promptly to chaulmoogra oil; the addition of strychnin seems to accentuate the effect of the oil; perhaps the camphor used in Heiser's cases serves the same purpose as a stimulant and may account for the lack of any need of strychnin, which was not employed in the cases reported. We must also give full credit to the hot baths with bicarbonate of soda (carbonate of soda is used at the Louisiana Leper Home); hot baths alone have benefited cases of leprosy, and more than one remedy has seemed to do good, *when taken in conjunction with hot baths.*

The review of the treatment of leprosy during the past thirty years shows a wide variety of remedies employed—all more or less empirical, if we except the serums and vaccins. Quite a number of medicines has been urged as specific. Crocker reported one case cured with the hypodermic use of perchlorid of mercury. Fox (G. H.) used both strychnin and arsenic, as well as chaulmoogra oil. Unna was strongly impressed with the value of ichthyol internally, at one time. Goldschmidt and Gruenfeld used euophen with favorable results.

Hoang-nan, a South American similar of strychnin, and belonging to the same genus as *Nux strychnos*, had vogue for several years. *Tua Tua*, an herbaceous plant of Brazil, was actually cultivated by the Department of Agriculture and distributed, because of the notice given its qualities against leprosy.

Salicylate of soda, salol, creosote, chlorate of potash, red mangrove bark, iodine salts, cacodylate of soda, salvarsan and numerous other remedies have been employed at various points

and at various times. None of these has stood the test of universal use.

Topical treatment, by nerve stretching, cauterization, escharotics (including the "moxa" of the Japanese), such as caustic soda, pyrogallie acid, etc., has been also employed. The X-ray has been used and at one time promised large hope—from the supposed effect it had in destroying the bacilli in the local lesion, and by disseminating the dead bacilli, produce a reaction against remote organisms. The relapse of patients so treated occasioned the abandonment of this method. Radium has been used—with, perhaps, less reason.

Serums have been numerous; those of Laverde, Carrasquilla, Rost (really a sort of vaccin, called "leprolin"), Serra, may be mentioned. Vaccins, too, have been used, derived from the bacillus, supposed to be of leprosy, in culture. Those of Clegg and Duval are types—but neither has proven really curative in spite of the reactions observed. This probably has been due to the chaotic state of the leprosy organism, still in doubt as to culturability and even as to type, though several bacteriologists have claimed cultivation, with strains showing wide dissimilarities in some instances.

Several *near*-vaccins have been suggested, the most advertised being nastin-B, first suggested by Deycke-Pasha and Rechad Bey. It seems to be really only a fatty derivative of acid-fast organisms from leprosy tissues, supplemented with the addition of benzoylchlorid. The industry of the manufacturers has occasioned rather widespread use of this remedy, for the most part without conclusive results.

Snake venom and anti-venomous serum have been used, based upon the accidental and superstitious effects of the bite of poisonous snakes. The use of the substance of snakes among the Chinese is old in tradition.

Tuberculin was extensively tried at one time, with negative results. Even the active organisms of erysipelas were employed—also without result. Normal horse serum has been used without appreciable effect.

In summing up so multifarious an assortment of procedures it is hard to cast aside any one which may have scored. The fact remains that among the remedies employed none has seemed more consistent in its results than chaulmoogra oil, and no remedy has been more extensively used. That the curative effect of the remedy has not been more general may be due to the fact that it has not been sufficiently tried. In the first place, chaulmoogra oil must be as nearly crude as possible to produce effect. We have the knowledge that among early Louisiana cases, when refined oil was used, no effect was had; as soon as we began with crude oil (congealing at 75° to 80° Fahrenheit) the results were prompt. At first the dosage, following Hillis, was only at a maximum of 10 or 15 drops. When patients could take 100 or more drops at the dose, improvement was rapid.

The old regimen of Beauperthuy, noticed by Bakewell in 1890 (*Brit. Med. Jour.*, May 31, 1891), had many good points which should not be overlooked. These were, essentially, hygienic surroundings, liberal diet, and persistence in any remedy undertaken.

The morale of a leper is easily lost and this is a factor of moment and often overlooked. The neglect of the treatment may condemn the remedy.

We have over twenty years of experience in the disease and have found no succedaneum for chaulmoogra oil and the hope of shortening the period of treatment by the method suggested by Heiser is indeed encouraging and promising.

Isadore Dyer.

Trisodic Citrate for Pellagra.—Alessandrini and Scala, in a paper published in the *Bulletin* of the Royal Academy of Medicine, at Rome, during the past year, have ventured a specific theory of pellagra and a treatment which is quite divergent from those at present before the profession.

So many ideas of pellagra have been suggested, however, that it is well to review each in the aim at some conclusion, particularly when, just now, one group of observers insists on the infectious causation and another proves to its satisfaction that diet is and can be the only factor at fault.

It is refreshing then to turn to the theory of Alessandrini and Scala, who attribute the disease to silica from drinking water, through which colloidal silica, fixing the chlorid of sodium with proteid substance in the tissues, increases the acid intoxication of the individual, by the release of hydrochloric acid.

The remedy suggested is a proper alkali, and trisodic citrate is given in 5 to 10 per cent. solution by hypodermic injection in daily dosage of 1 c. c.; the check on the chlorin elimination is determined by regular examination of the urine.

The experiments conducted by the observers were quite extensive and most interesting and deserve to be noticed among our American commissions now seeking knowledge about the disease.

The clinical results would certainly indicate a trial of trisodic citrate by those who are seeking a remedy for pellagra.

Isadore Dyer.

ORIGINAL ARTICLES

LEPROSY.

Its Treatment in the Philippine Islands by the Hypodermic Use of Chaulmoogra Oil Mixture.*

By

VICTOR G. HEISER,

Surgeon, United States Public Health Service, Director of Health for the Philippine Islands.

In the United States Public Health Reports of September 5, 1913, two cases, and in the United States Public Health Reports of January 2, 1914, two additional cases, or a total of four, were reported as having been apparently cured of leprosy, and to have remained cured for a period of over two years. The first two cases were treated with a mixture of chaulmoogra oil, camphor and resorcin, and in addition they received at irregular intervals a vaccine prepared in a number of different ways from a strain of so-called leprosy cultures of Clegg. The other two cases received only hypodermic injections of the chaulmoogra oil mixture, no vaccine being used. The clinical records for the above cases, beyond establishing the diagnosis and that they were microscopically negative after treatment, were incomplete. With the hope, therefore, of having more satisfactory data available, 12 cases, which included the different types of leprosy, were placed under treatment February 21, 1912, with the same chaulmoogra oil mixture as was used in the cases already reported as apparently cured. The object of this paper is to present the results that were obtained. Unfortunately the clinical records of these cases also are not nearly as complete as desirable, but with the appended photographs and diagrammatic charts that were made at the time the treatment was begun and at subsequent intervals an idea of the results may be had. The following cases were selected and placed under the immediate charge of the house physician of San Lazaro Hospital, Manila, Dr. Elidoro Mercado.

*Read by title at the eleventh annual meeting of the American Society of Tropical Medicine, held in Boston, Mass., May 29 and 30, 1914. Published with the permission of Surgeon General Rupert Blue of the Public Health Service.

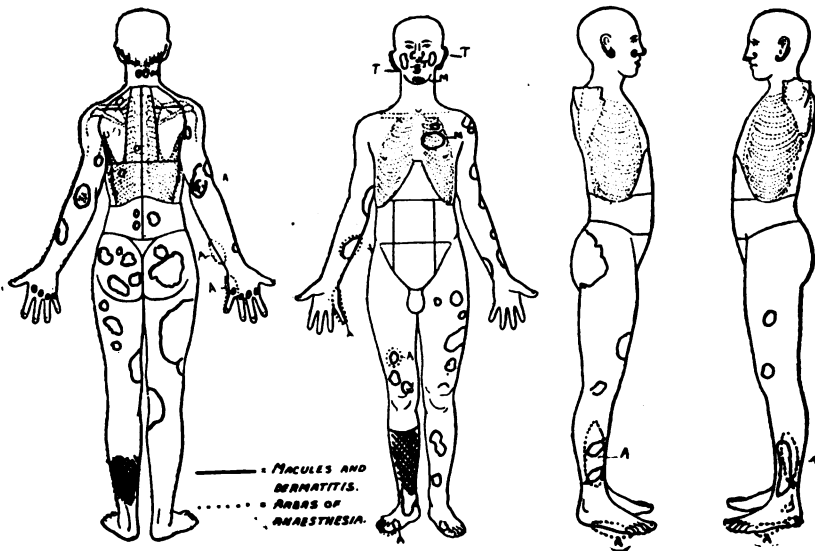
Case I.

H. P., age 17, male, single, Filipino, native and permanent resident of Binangonan, Rizal Province; occupation, rope maker. Admitted to the San Lazaro Hospital November 3, 1911. Placed under treatment in this series February 21, 1912.

Family History.—Father died of pulmonary tuberculosis, mother of cholera. One sister died of tuberculosis at the age of 25.

Personal History.—Does not smoke. Habits moderate. Has eaten fish and rice three times daily ever since he can remember; meat usually once a week. In 1903 had smallpox.

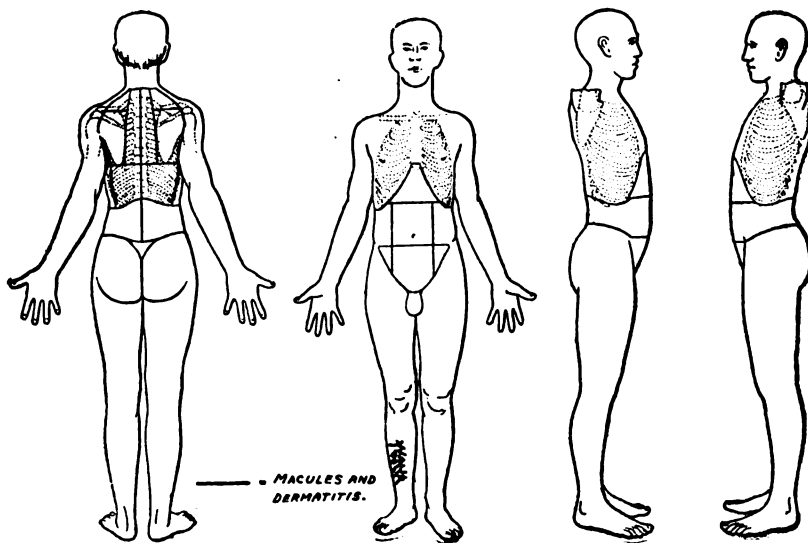
Present Illness.—First noticed in 1905, when he had a numb sensation in the toes of both feet, which has persisted to date. During May, 1911, the lobes of his ears began to enlarge. Several months prior to his admission to the hospital he had scabies.



CASE I.—Diagram made February 21, 1912, showing distribution of lesions.

Present Condition.—Evidence of smallpox scars on face. A distinct tubercle can be felt near the tip of the nose. The edges of the nostrils are reddish, shiny, and indurated. The chin is reddish and apparently infiltrated. The cheeks are reddish and shiny, but there is no induration. The borders and lobes of both ears are thick, hard, enlarged, and small tubercles can be felt in the lobes. The bulk of the lobes is apparently double that of normal. There are leprous macules on the back of the neck, on the chest, lumbar region, arms, and on the dorsal surfaces

of the forearms, hands, and fingers. There is anesthesia of the soles of the feet, and he gives a history of frequently walking about in his bare feet without knowing that he had lost his slippers.



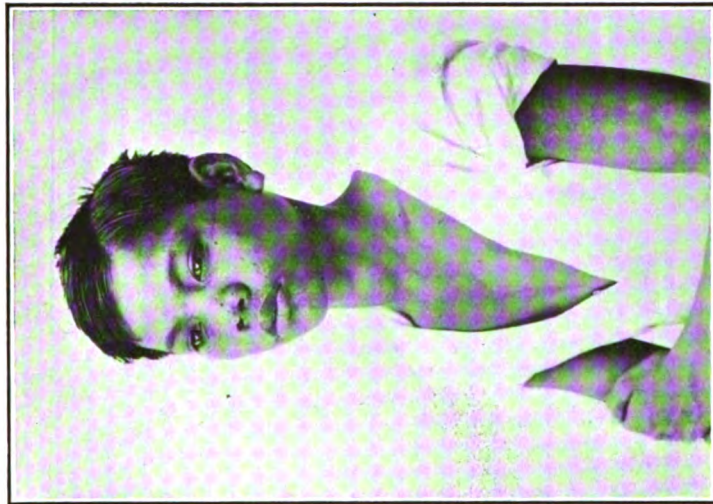
CASE I.—Diagram made April 15, 1914.

Diagnosis.—Clinical diagnosis: Hypertrophic leprosy, confirmed by microscopical examinations made by the bureau of science and also by the house staff at the San Lazaro Hospital.

Treatment.—On February 25, 1 c. c. of the chaulmoogra-oil mixture was injected into the buttocks. This was repeated at weekly intervals and the dose increased 1 c. c. at each injection until a dose of 5 c. c. was reached. Every other day he was given a hot tub bath in a 2% solution of sodium bicarbonate. Saline purgatives were administered whenever constipation appeared. Beginning June 15, the dose was again increased 1 c. c. per week until a dose of 8 c. c. was reached. On October 30, the dose was reduced to 5 c. c. and the intervals were increased to every three days. Beginning November 6, the dose was reduced 1 c. c. every week until 1 c. c. was reached, and this quantity was then injected every six days, and continued to date (April 15, 1914).



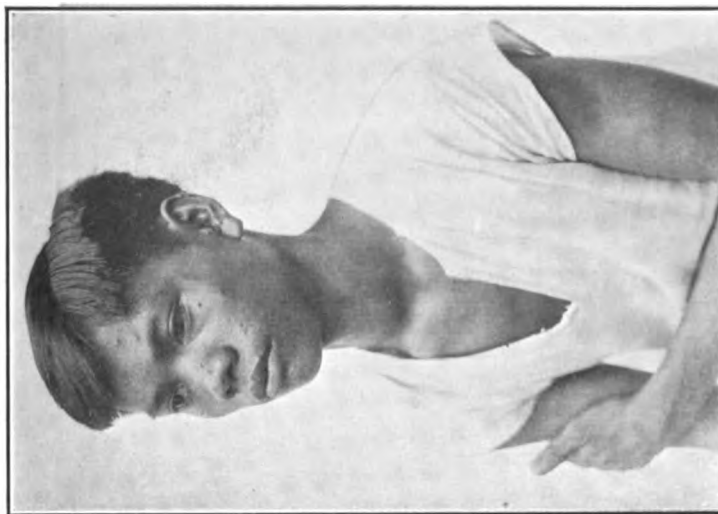
CASE I.—Photographed February 21, 1912. Enlargement of the lobe of the left ear is plainly evident, as well as the leprosy deposits in the helix of the ear. Note infiltration of the alae nasi, macules above chin and on the left arm, and tubercle on tip of nose.



CASE I.—Photographed August 19, 1912. Note reduction in size of lobe of ear. Macules plainly evident.



CASE I.—Photographed October 28, 1913.



CASE I.—Photographed April 15, 1914. Ear and nose normal in size. Tubercle on tip of nose and macules have disappeared.

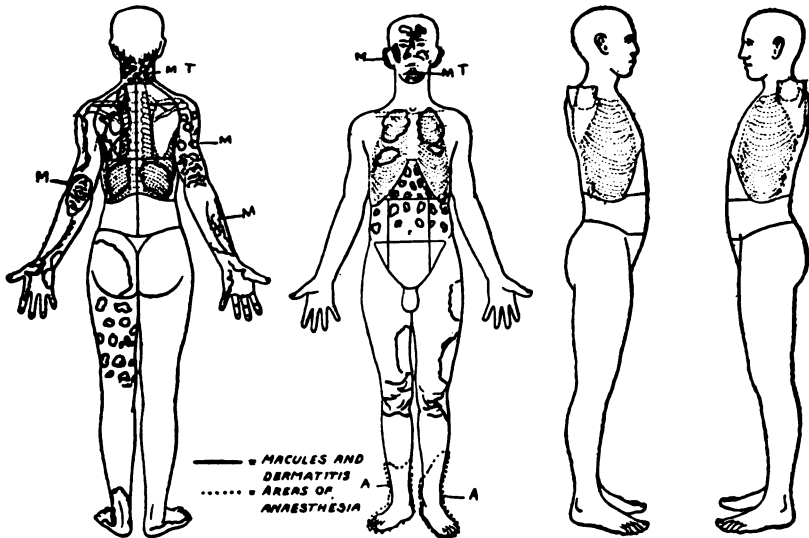
Description of Lesions During Treatment.—During September, 1912, the macules became yellowish and the tubercles throughout the body became soft. This improvement continued, and by November, 1913, practically all macules had disappeared and the tubercles had undergone absorption. The ears were almost normal in size, as may be seen from the photographs.

Upon examining the feet with a needle it was found that the sensation had returned and the patient declared that he could feel the slippers on his feet. The results of the bacteriological examinations since the treatment began are as follows:

Date.	By Whom.	Result.
November 3, 1911.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	do	Negative.
May 27, 1913.....	do	Suspicious.
June 5, 1913.....	do	Negative.
November 4, 1913.....	do	Do.
February 8, 1914.....	Dr. Mercado.....	Do.
April 15, 1914.....	Bureau of science.....	Positive.

Result.—The patient, on April 15, 1914, was clinically negative for leprosy, but on this date was again microscopically positive.

Case II.

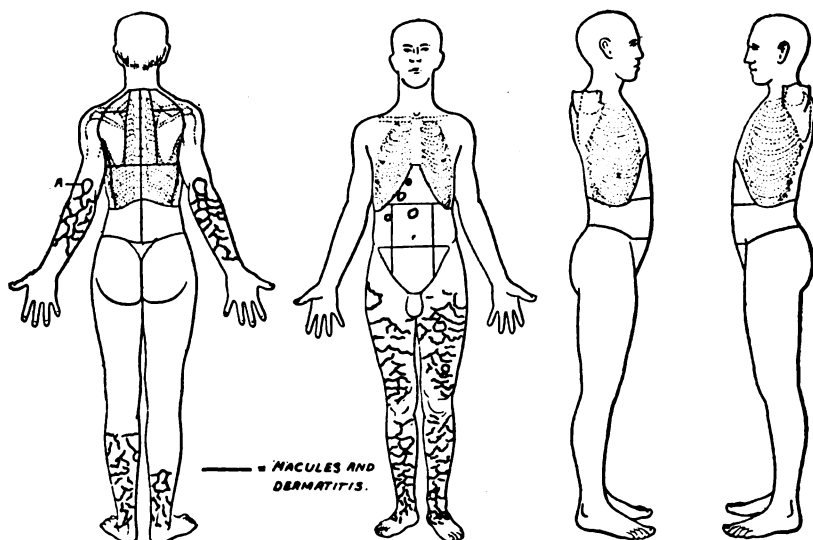


CASE II.—Diagram made February 21, 1912, showing distribution of lesions.

V. R., age 78, male, single, Filipino, born and lived at Cautit, Cavite Province; occupation, fisherman. Admitted to the San Lazaro Hospital, November 7, 1911. Placed under treatment in this series February 21, 1912.

Family History.—Parents died of tuberculosis. A nephew who spent much time with him died of leprosy a number of years ago.

Personal History.—Chews betel nut and tobacco. Habits good. States that at the age of 40 he had rheumatism in the right leg, which caused



CASE II.—Diagram made April 15, 1914.

dislocation of the head of the femur and shortening of the leg. He has eaten fish and rice three times daily during his whole life; meat usually only once a week.

Present Illness.—Four or five months prior to admission there appeared on his cheeks macules, which he first noticed after working for a number of hours in water with his fish nets. Similar lesions then appeared on other portions of his body, as shown in the diagram.

Present Condition.—The sclera of both eyes is inflamed. Outer half of eyebrows is gone. There are small red tubercles on the forehead, nose, cheeks, and chin. There are macules also in the same regions, some of which coalesce. (See diagram.) The fingers and toes are slightly atrophied. There is a fatty tumor in the back of the neck about 15 centimeters in diameter, and elevated about 3 centimeters above the surface. (This is found frequently in Filipinos who carry heavy weights on their backs.) The skin over the forearms and backs of the hands is markedly atrophied

and gives the sensation of tissue paper when touched. The right leg is about 7 centimeters shorter than the left, which is due to the luxation upward of the head of the femur.

Diagnosis.—Clinical diagnosis: Atrophic leprosy, confirmed by microscopical examination made by the bureau of science.

Treatment.—Beginning February 21, 1912, 2 c. c. of the chaulmoogra-oil mixture was injected into the buttocks every 8 days, and the dose increased 1 c. c. each week until 4 c. c. was reached. Beginning October 26, 1912, the injection was made every 3 days. On April 30, 1913, the dose was decreased 1 c. c. each week until 1 c. c. was reached, but the injection was repeated every 3 days instead of at weekly intervals as before.

Description of Lesions During Treatment.—During the first year there was not much apparent change in his condition. Toward the end of April, 1913, he began to improve. Appetite increased and his strength returned. The tubercles became soft and the lobes of the ears gradually became smaller. Improvement slowly continued. By November, 1913, the macules in the face had almost disappeared. The ears were normal. The infiltrated areas associated with the macules disappeared, and the sites of the former lesions became of the same level as the surrounding tissue. On April 7, 1914, evidences of clinical leprosy had almost disappeared. The result of the change in his condition may be seen from the accompanying diagram.

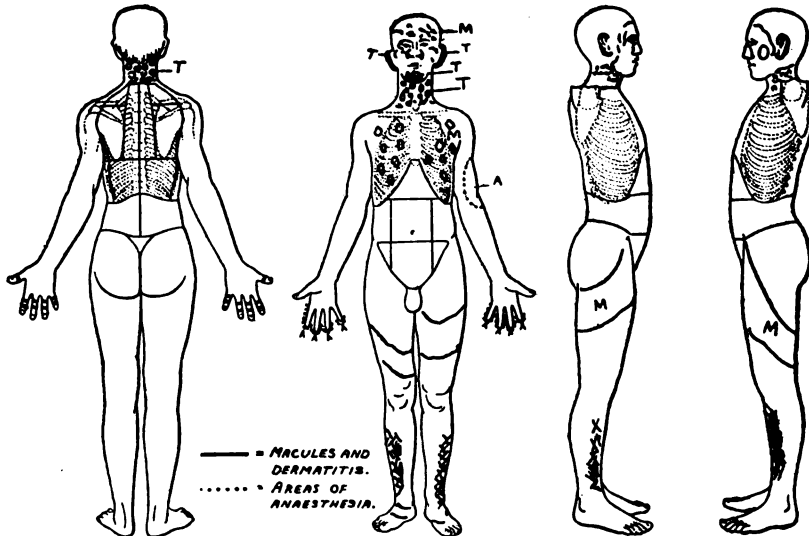
The results of the bacteriological examinations made are as follows:

Date.	By Whom.	Result.
November 7, 1911.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	..... do	Do.
April 15, 1914.....	..... do	Do.

Result.—General health much improved. Leprous infiltrations almost entirely absorbed. Swelling and redness are less.

Case III.

L. C., age 24, male, single, Filipino; occupation, public carromata driver. Born at Baliuag, Bulacan. Admitted to the San Lazaro Hospital February 19, 1912. Placed under treatment in this series February 21, 1912.



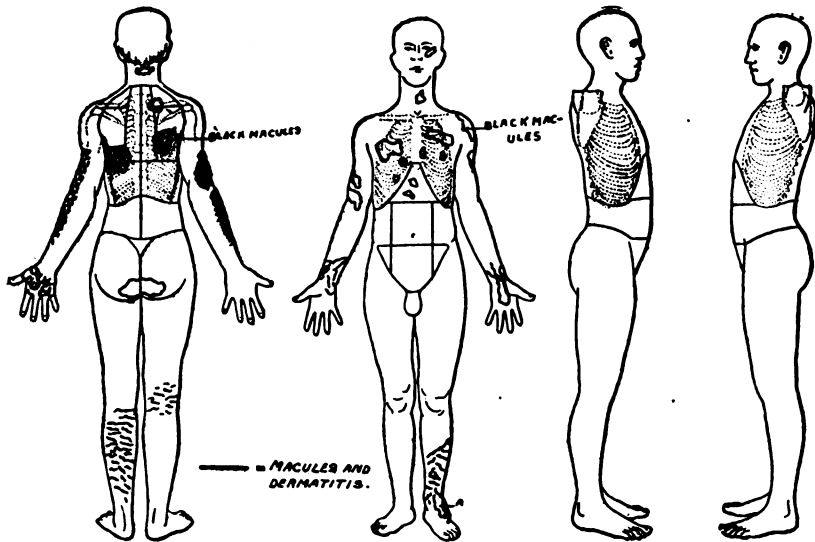
CASE III.—Diagram made February 21, 1912, showing distribution of lesions.

Family History.—Father and mother died while he was a boy. Has one cousin who is a leper, but claims he did not associate with him.

Personal History.—Uses tobacco moderately. Lived in a provincial town prior to his admission, and several years prior to that he was a soldier stationed at different parts of the islands. He does not remember having had any disease or illness before the present one, except scabies at the age of 20, while he was a soldier.

Present Illness.—Present illness began at the age of 20, soon after his attack of scabies, with fever and pains in the arms and legs, which lasted for a week or more. Soon afterwards he noticed reddish spots on his face.

Present Condition.—Face distinctly leonine. Almost complete loss of eyebrows. Thick reddish indurated macules on the forehead, chin, and cheeks. Heavy furrows in face. Eyelids and nose hypertrophied. Nostrils almost occluded by the infiltration. Cheeks shiny and thick. Chin shows heavy leprous deposit. Cartilage of *alæ nasi* almost completely absorbed. Small tubercles distributed over arms and chest. Macules over chest and large macules over thighs. Skin over tibia is dry and ichthyotic in appear-



CASE III.—Diagram made April 15, 1914.

ance and gives a sensation of dry tissue paper when felt. Feet swollen. Toes atrophied. Loss of sensation on the outer surfaces of the arms and lower extremities. Distribution of the lesions may be seen from the foregoing diagram.

Diagnosis.—Hypertrophic leprosy, microscopically confirmed by the bureau of science.

Treatment.—February 21, 1912, 3 c. c. of the chaulmoogra-oil mixture was injected into the buttocks. This was repeated at intervals of three days, and at times part of the dose was injected into the infiltrations in the ears and face. Beginning Sept. 15, 1912, the dose was reduced gradually to 2 c. c. every eight days. During October, 1 c. c. was given every three days, and that dose has been continued until the present time (April 15, 1914).

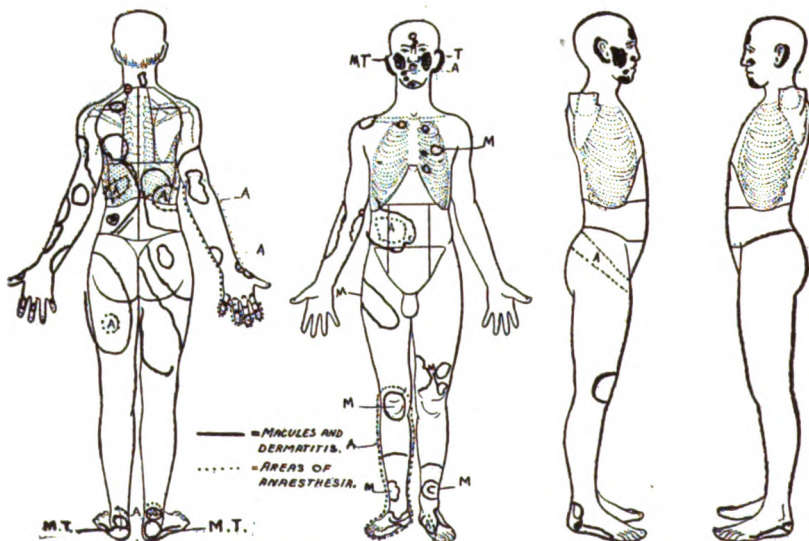
Description of Lesions During Treatment.—Toward the middle of September, 1912, the nodules had begun to soften, but apparently not much absorption had taken place. At various times some of the macules broke down and became large open ulcers. By November, 1913, all lesions had improved somewhat

and an improvement in his physical condition was quite noticeable. April 7, 1914, he had septic fever, due to a large ulcer which had appeared on the back of his hand and forearm, and the patient was confined to his bed. The accompanying photographs and diagram show the condition of his lesions at present.

Result.—The large leprorous deposits have been almost completely absorbed. Cosmetic result good. Case apparently still improving.

Case IV.

A. M., age 23, male, Filipino; occupation, farmer; born and lived in Sampaloc, Manila; admitted to the San Lazaro Hospital August 10, 1911; placed under treatment in this series February 21, 1912.

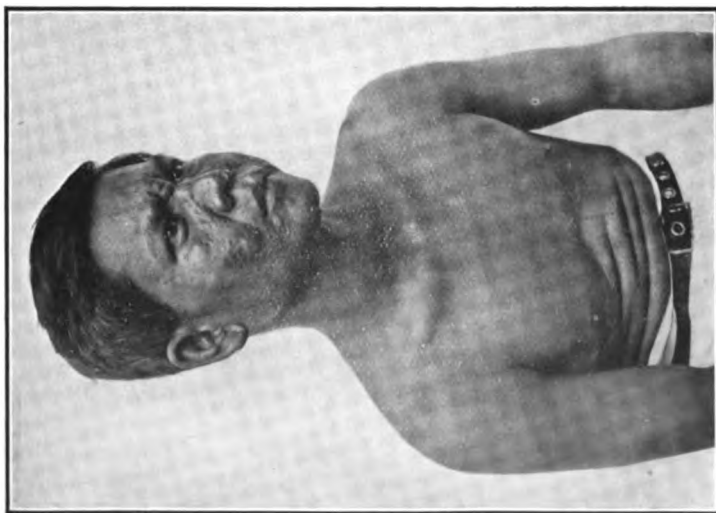


CASE IV.—Diagram made February 21, 1912, showing distribution of lesions.

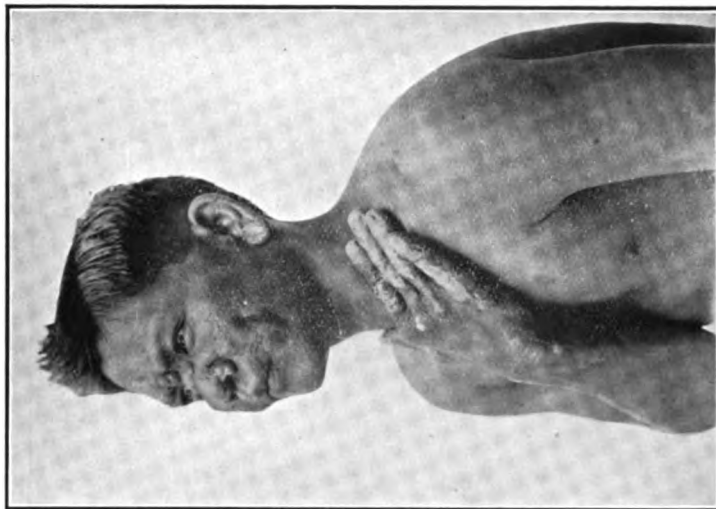
Family History.—Father and mother living and well; 10 brothers, youngest is 1 year of age; lived in house with 12 other members of family, none of whom show any signs of leprosy.

Personal History.—Uses tobacco moderately and lives a moderate life; had smallpox at 8 and soon afterwards malarial fever; does not remember having had any other disease.

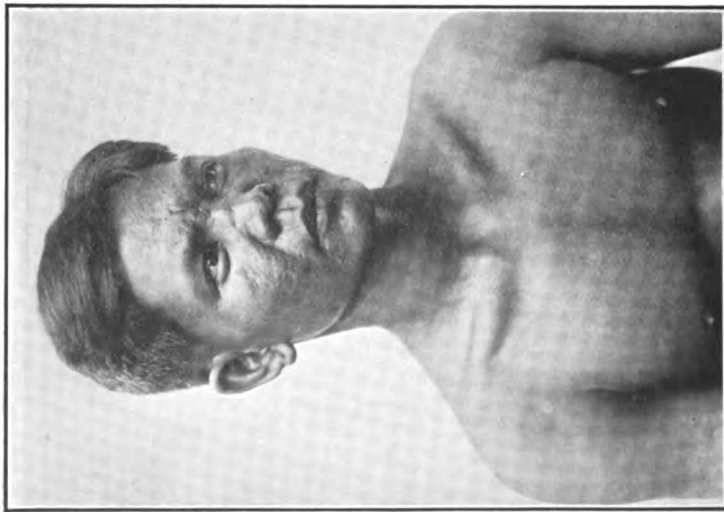
Present Illness.—In 1907 he had pains in his knees and muscles of the thighs and arms. He would often drop the slippers from his feet with-



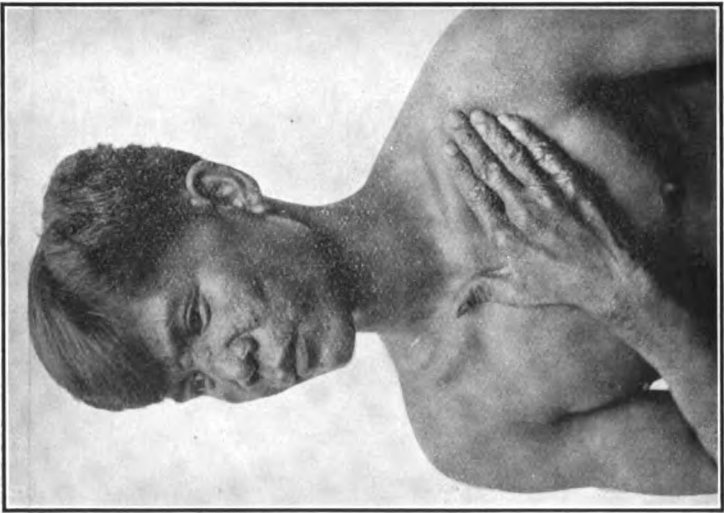
CASE IV.—Photographed February 21, 1912. Note marked enlargement of lobe of ear and of the nose and numerous tubercles distributed over the face.



CASE IV.—Photographed August 19, 1912. Note leprous ulcers on dorsal surface of fingers.



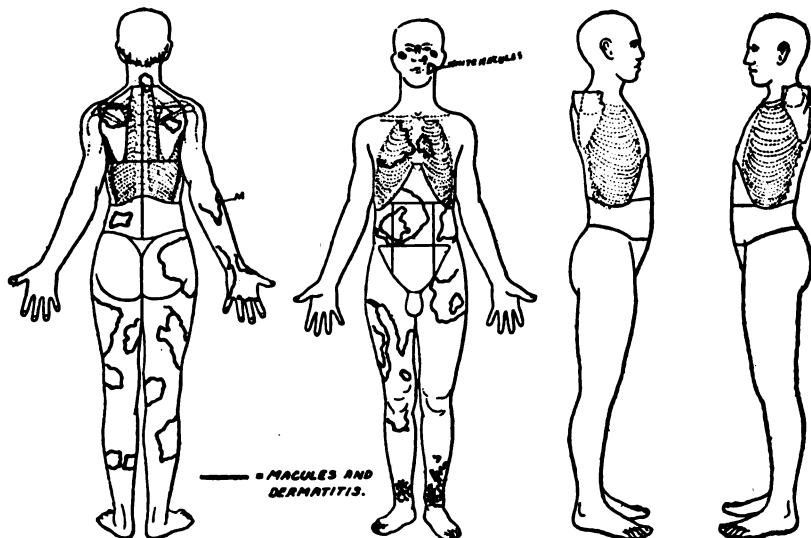
CASE IV.—Photographed April 15, 1914. View of right side of face. Ear and nose almost normal in size. Lobe of ear shows deep notch where tumor existed before.



CASE IV.—Photographed April 15, 1914. View of left side of face. Note that infiltration of ear and nose have been absorbed. Leprous ulcers on dorsal surface of fingers are healed.

out being aware of it. Loss of sensation later affected the hands. In 1911 he noticed reddish spots on the face and hands.

Present Condition.—Large macule on the forehead, reddish and shining and slightly elevated above the surrounding surface. Across the saddle of the nose there is a deeply infiltrated band, almost copper colored, and well raised above the surface. There is a large nodule on the upper lip and there are many smaller nodules in the cheeks, chin, and forehead. Backs of hands, especially of fingers, show atrophy of the skin and give



CASE IV.—Diagram made April 15, 1914.

sensation of tissue paper when touched. Dorsal surfaces of fingers of left hand are ulcerated. Other lesions throughout the body are principally macules, as shown on the accompanying diagrammatic chart. Sense of smell almost completely gone. This was apparently due to blocking of the nose by leprosy infiltration. A puslike discharge from the nose is present. The face is distinctly leonine in appearance.

Diagnosis.—Mixed leprosy, which was microscopically confirmed by the bureau of science.

Treatment.—One c. c. of the chaulmoogra-oil mixture was injected into the buttocks February 21, 1912, and increased 1 c. c. per week until 5 c. c. were reached. Injections were made at intervals of one week. Beginning April 10, 1912, the dose was gradually increased to 8 c. c. December 1, 1912, the dose was increased again until he was taking 10 c. c. every 3 days. This was continued

until February, 1914, and was then gradually reduced until he was taking 4 c. c. every 3 days.

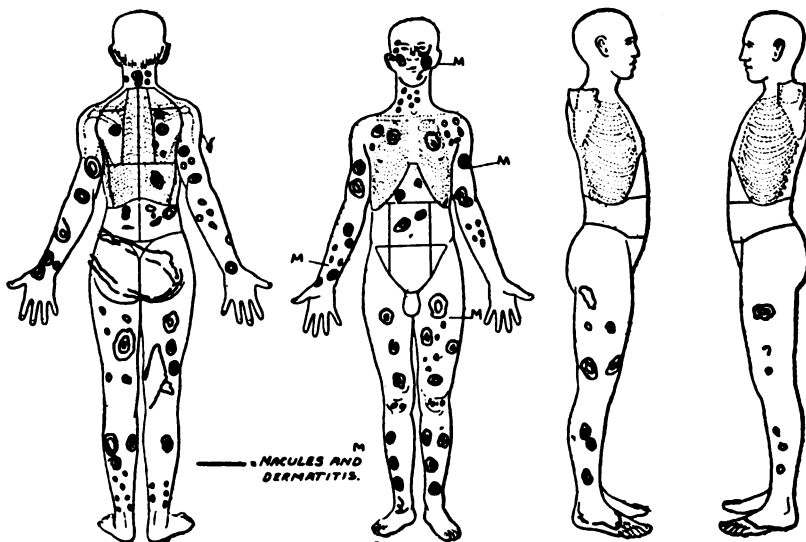
Description of Lesions During Treatment.—The macules, by March, 1913, had largely disappeared and the infiltration of the nose was considerably reduced. The sense of smell had returned almost completely and all discharge had practically disappeared. The ears gradually became smaller until they are now nearly the normal size. The ulcers on the fingers underwent cicatrization. The sensation in the feet and hands was tested with a needle and found to be almost normal. The present condition of the lesions may be seen from the accompanying photographs and diagrams.

Microscopical examinations resulted as follows:

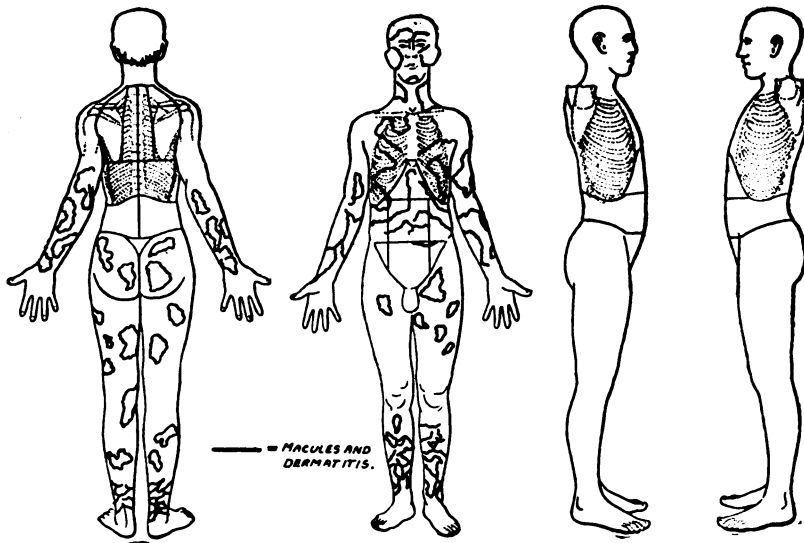
Date.	By Whom.	Result.
January 15, 1912.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	do	Do.
April 15, 1914.....	do	Do.

Result.—Leprous deposits almost entirely absorbed. Ulcers healed.

Case V.



CASE V.—Diagram made February 21, 1912, showing distribution of lesions.



CASE V.—Diagram made April 15, 1914.

F. C., age 18, male, single, Filipino; occupation, laborer in printing office. Admitted to the San Lazaro Hospital April 10, 1911. Placed under treatment in this series February 21, 1912.

Family History.—Denies having any leprosy relatives or friends. Ten members in his family, all well, lived in the same house with him. None of them contracted leprosy.

Personal History.—Eats very general diet; rarely eats fish. Habits good. At 10 years of age had an attack of scabies.

Present Illness.—Dates back some 16 months previous to admission to hospital, following rheumatic pains in the arm and knee joints.

Present Condition.—The face is covered with many ringlike, non-elevated macules, reddish and shiny in appearance. The ears are reddish and thickened at the edges. The lobes are distinctly enlarged. There are numerous macules on anterior and posterior surfaces of the body. The little finger is partly contracted. The toes and fingers are somewhat swollen. Patient has a robust constitution and is of average strength.

Diagnosis.—Leprosy, microscopically confirmed by the bureau of science.

Treatment.—Chaulmoogra oil was injected, as in the other cases. A dose of 10 c. c. was finally reached on March 1, 1913. This dose is being given at the present time. Two per cent hot sodium bicarbonate baths of a half-hour duration were pre-

scribed every two days, but the patient seldom carried out these instructions.

Description of Lesions During Treatment.—Much of the scaliness of the body has disappeared and the macules have become paler in color. There is apparently not much improvement. Lesions are perhaps somewhat reduced in size, and there is less contraction of the little finger. The condition of the patient may be seen from the diagrammatic chart.

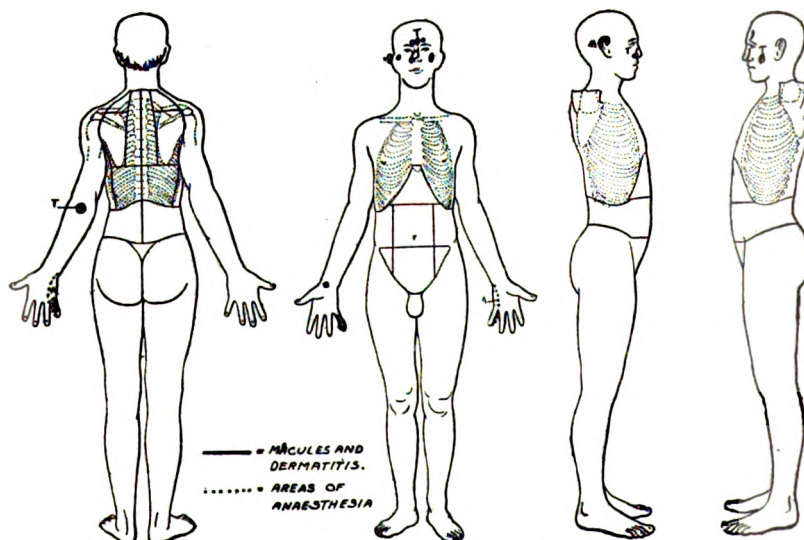
Result.—No great change in appearance. General health is better. Leprous deposits have been partly absorbed. Disease arrested.

Case VI.

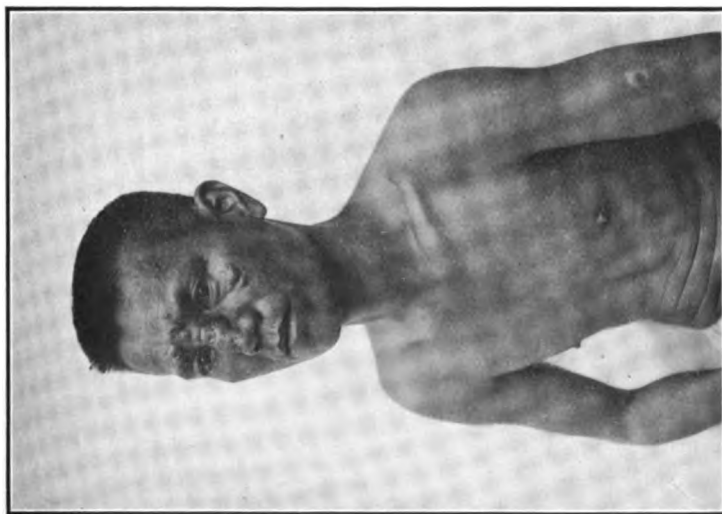
P. S., age 35, male, married, Filipino; occupation, fisherman. Admitted to the San Lazaro Hospital February 12, 1912. Became a member of this series February 21, 1912.

Family History.—Mother died of pulmonary tuberculosis 13 years ago. Father living and well. Has a child aged 7, one aged 3, one brother, and three sisters, all of whom are living and well.

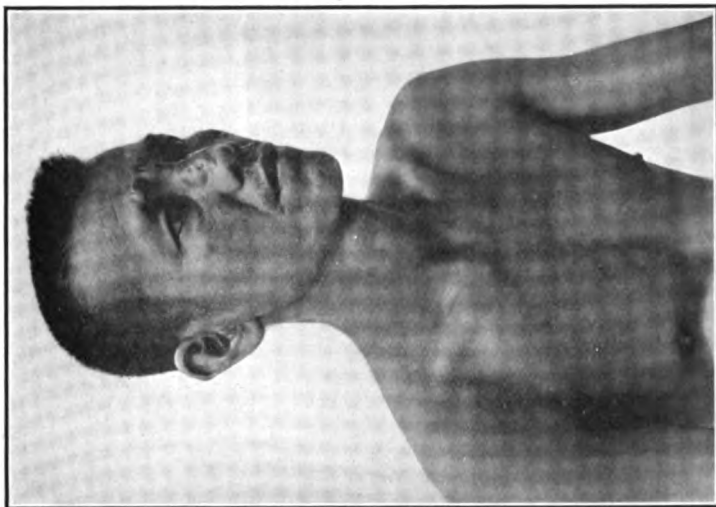
Personal History.—Has eaten rice and fish three times daily ever since he can remember, and in addition he has had the average diet; meat usually once a week. Does not remember having had any other disease.



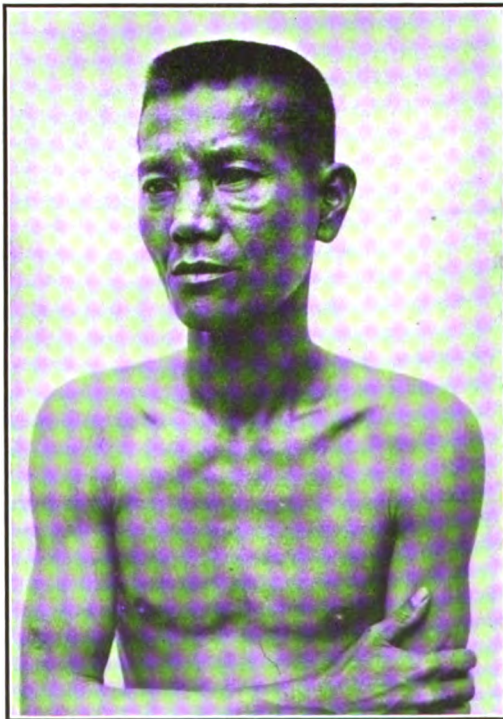
CASE VI.—Diagram made February 21, 1912, showing distribution of lesions.



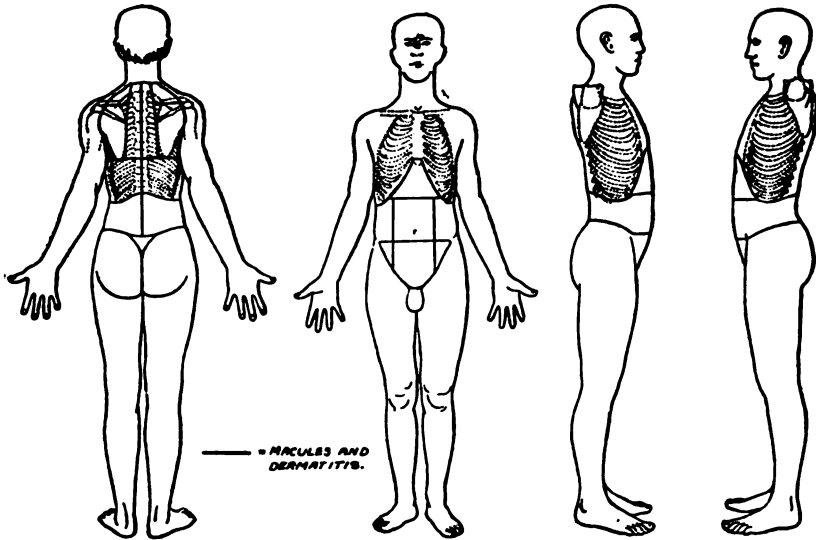
CASE VI.—Photographed February 21, 1912. Shows considerable enlargement and thickening of the root of the nose and a tubercular deposit between the eyes. Eyebrows almost completely gone.



CASE VI.—Photographed August 19, 1912. Shows right side of face.



CASE VI.—Photographed April 15, 1914. Infiltrations about nose have practically disappeared. Face has almost normal appearance.



CASE VI.—Diagram made April 15, 1914.

Present Illness.—Began two years ago with the appearance of spots on his nose, which later turned into a lump. After this similar spots appeared on the forehead and cheek. There was considerable numbness along the external borders of the little finger of the left hand. He also complained of a loss of appetite.

Present Condition.—There are three distinct, hard, shiny, round, reddish macules on the forehead. Over both malar bones there are masses beneath the skin. The upper edge of the right ear is reddish, hard and shiny. On the apex of the left elbow there is a small, red macule. The little finger of the left hand is reddish and hypertrophied. The *ala nasi* are indurated and blackish in appearance. Contraction of fingers of left hand most marked in the little finger. Loss of sensation on outer border of left hand.

Diagnosis.—Hypertrophic leprosy, microscopically confirmed by the bureau of science.

Treatment.—Began by injecting into the buttocks 2 c. c. of the chaulmoogra oil mixture every eight days. The dose was gradually increased until on April 19, 1912, he was given 5 c. c. every three days. On February 21, 1913, the dose was gradually increased to 10 c. c., and since February 14, 1914, he receives 5 c. c. one week and 10 c. c. the next week. A portion of the dose is frequently injected into the infiltrated lesions.

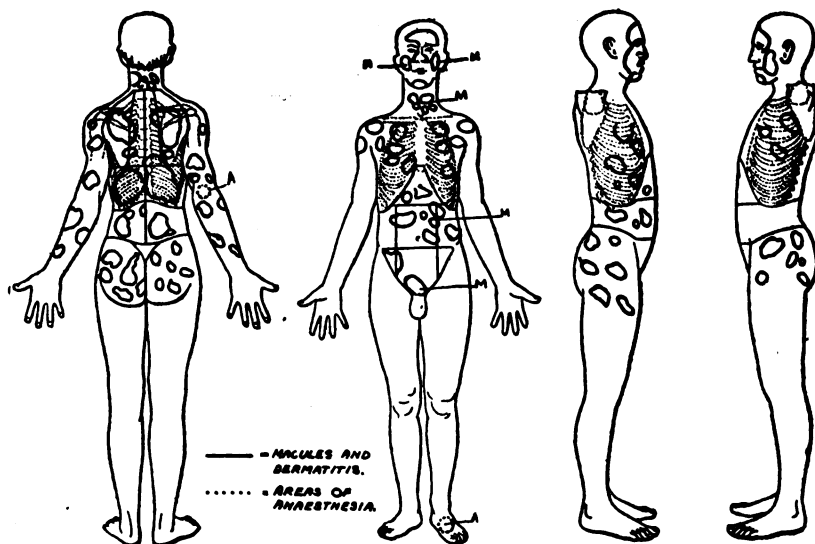
Description of Lesions During Treatment.—After some months gradual improvement set in, and by October, 1913, the macules began to disappear and the lesions were no longer raised above the surface. The general condition improved. At this writing, (April 15, 1914) all tubercular infiltration has practically disappeared, including the large tubercular mass in the nose and forehead. The contraction of the fingers of the left hand has disappeared. Tested with a needle, the sensation in the left hand is now hypersensitive. He eats and sleeps well, and there is abundant evidence of marked improvement. The photographs and diagram show his present condition.

The record of the microscopical examinations is as follows:

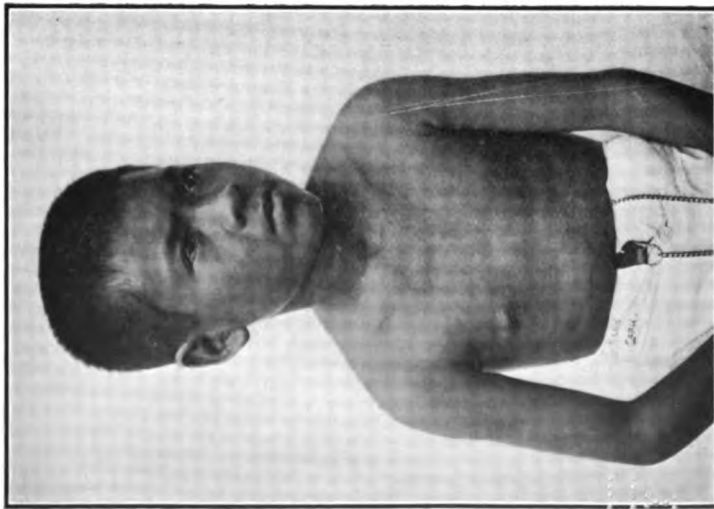
Date.	By Whom.	Result.
February 12, 1912.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	do	Do.
May 27, 1913.....	do	Do.
April 15, 16, and 25, 1914.....	do	Negative.

Result.—Leprous deposits almost completely absorbed and outward signs of leprosy almost disappeared.

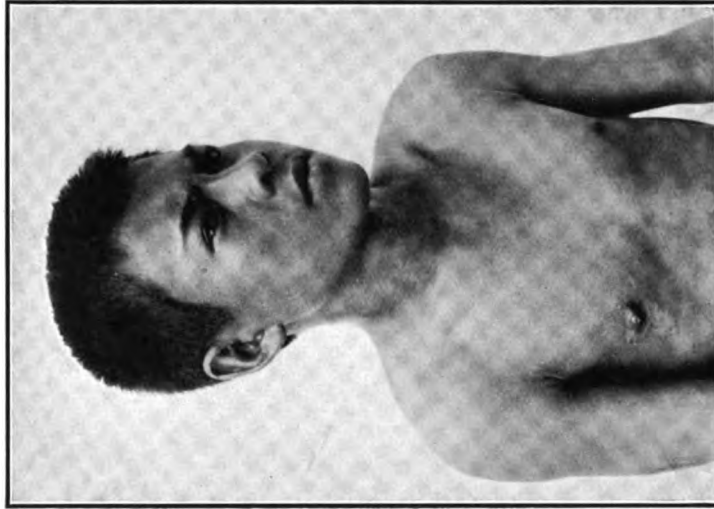
Case VII.



CASE VII.—Diagram made February 21, 1912, showing distribution of lesions.

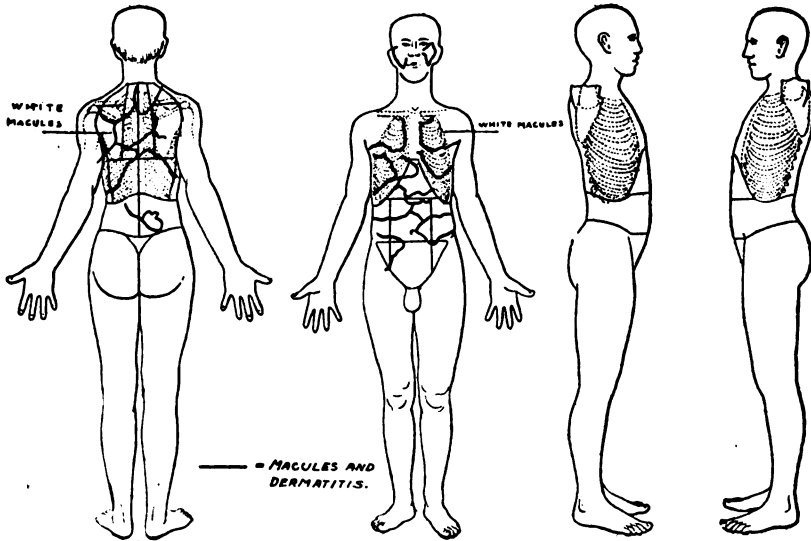


CASE VII.—Photographed February 21, 1912. The infiltration of nose and ears not marked. Macules on body barely discernible. There is a general suffusion of the face not brought out by the photograph.



CASE VII.—Photographed April 15, 1914. Shows only slight change. Eyebrows somewhat thicker.





CASE VII.—Diagram made April 15, 1914.

P. R., age 12, male. Born and lived in Cebu. Occupation, school-boy. Admitted to San Lazaro Hospital December 25, 1911. Placed under treatment in this series February 21, 1912.

Family History.—Father died of cholera 10 years ago. Mother, brothers, and sisters living and well. Denies having leprosy relatives or friends.

Personal History.—Smokes. Has regular habits. Does not remember having been ill.

Present Illness.—Began seven years ago with a reddish appearance of the face. No pronounced symptoms. About six months ago had a fever which lasted a number of days, after which the redness markedly increased.

Present Condition.—The skin of the forehead is red and is somewhat glossy and dry. The lobes of the ears and border of the nares are somewhat thickened and indurated. The chin is likewise reddish and slightly indurated. Whitish, and also a few red, macules appear on various portions of the body as shown in the foregoing diagram. This case, with the exception of the whitish spots distributed over the body, had few signs of leprosy. The infiltration about the face was so even that the only noticeable effect produced was a suffused appearance of the countenance.

Diagnosis.—Mild hypertrophic leprosy, microscopically positive.

Treatment.—February 21, 1912, began with 1 c. c. of the chaulmoogra-oil mixture, repeated every eight days until 5 c. c. were reached. Two per cent sodium-bicarbonate baths given daily for a period of 30 minutes. Saline purgatives were given regularly at intervals of 10 days. In September, 1912, dose was increased to 5 c. c. every three days. This has been continued to date.

Description of Lesions During Treatment.—In September, 1912, the reddish areas on the face and body gradually faded. The boy became more robust. On October 25, 1913, there were few outward manifestations of leprosy. The boy was growing rapidly. On February 7, 1914, many of the reddish macules had turned white and resembled vitiligo. There is no marked change in the appearance of the boy, but the progress of the disease has evidently been arrested. The accompanying photograph and diagram show his present condition.

The microscopical examinations show the following results:

Date.	By Whom.	Result.
December 25, 1911.....	Drs. Mercado and Goff.....	Positive.
June 5, 1912.....	Bureau of science.....	Do.
November 4, 1912.....	do	Do.
May 19, 1913.....	do	Do.
June 5, 1913.....	do	Do.
April 15, 1914.....	do	Do.

Result.—Lesions somewhat improved. Progress of disease arrested.

Case VIII.

F. U., age 13, male, Filipino; occupation, schoolboy. Born and lived at Pagsanjan, Laguna. Admitted to San Lazaro Hospital January 15, 1911. Placed under treatment in this series February 21, 1912.

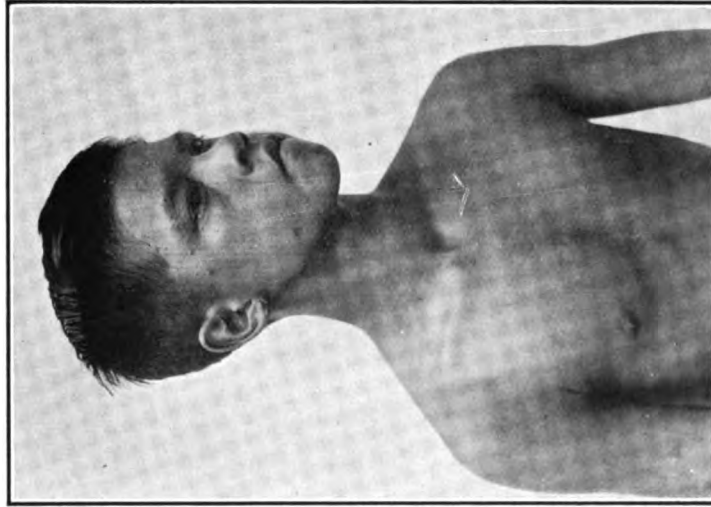
Family History.—Grandfather, who lived in the same house with his family, died of leprosy. Father and mother living and well. Two brothers and two sisters also well. Has a cousin afflicted with leprosy, now at Culion, who lived in the same town, but he denies association with him.

Personal History.—Smokes moderately. Always had very liberal diet at home. Had scabies at the age of 8. Does not remember having had any other disease.

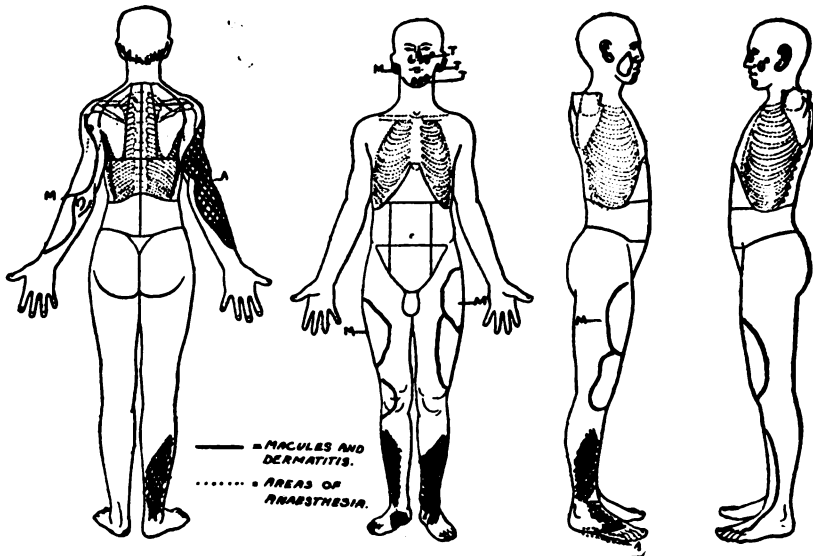
Present Illness.—Began about three years ago, when he first noticed red blotches upon his face. A few months prior to admission he noticed that he had reddish spots in his ears and on his nose.



CASE VIII.—Photographed February 21, 1912. Note enlargement of lobe of ear; infiltration of chin; tubercle, lower part of cheek.

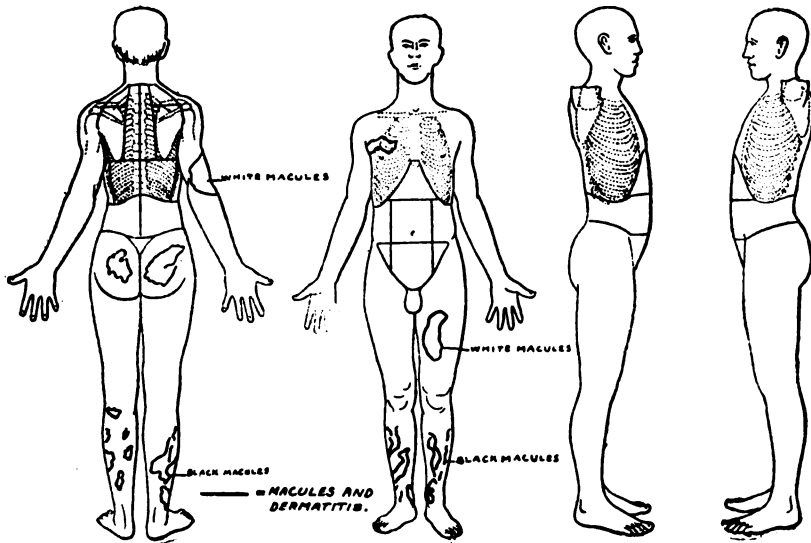


CASE VIII.—Photographed April 15, 1914. Note disappearance of enlargement of lobe of right ear and pits in place of tubercle on chin and cheek.



CASE VIII.—Diagram made February 21, 1912, showing distribution of lesions.

Present Condition.—Has a well-elevated, hard, reddish tubercle on the left side of the nose about its middle. Similar lesion on the left cheek. The latter, however, is dark and soft. The upper lip is hypertrophied,



CASE VIII.—Diagram made April 15, 1914.

reddish, and shiny. Three distinct tubercles can be felt in the chin. The right ear is enlarged and shows a well-elevated tubercle in the lobe. Macules in other parts of the body as shown in the accompanying diagram. There is distinct loss of sensation on outer part of the right foot.

Diagnosis.—Hypertrophic leprosy, microscopically confirmed.

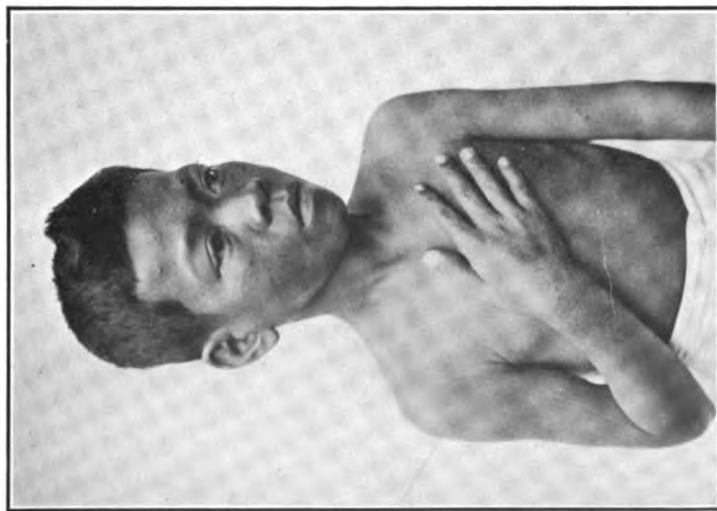
Treatment.—February 21, 1912, received in the buttocks an injection of 1 c. c. of the chaulmoogra-oil mixture. This was repeated every eight days and gradually increased to 5 c. c. On April 30 the dose was gradually increased until 8 c. c. were reached. On June 1, 1912, the dose was reduced to 5 c. c. every three days. Beginning October, 1912, the dose was gradually increased to 10 c. c. and then gradually reduced to 1 c. c. and given every three days. During May the dose was gradually increased to 10 c. c. and given every three days. At the present time this same dose is being continued. Hot 2 per cent sodium bicarbonate tub baths are given every few days.

Description of Lesions During Treatment.—A few months after the injections were begun there was an absorption of the lesions. The photograph shows the gradual reduction in size which took place in the large tubercles of the ear and nose. The general health improved and there was much evidence of constant improvement. The large notch which appears in the ears is due to the absorption of the leprous deposit between the cartilage of the helix and of the lobe. Sensation has returned in the areas of the foot that were anesthetic when the treatment began.

The microscopical examinations made by the bureau of science resulted as follows:

Date.	By Whom.	Result.
January 15, 1912.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	do.....	Negative.
May 27, 1913.....	do.....	Do.
June 2, 1913.....	do.....	Positive.
April 15, 1914.....	do.....	Do.

Result.—Practically no outward evidences of leprosy remain.



CASE IX.—Photographed February 21, 1912. Shows loss of eyelid; infiltration of nose and of right ear; swollen fingers.



CASE IX.—Photographed April 15, 1914. Less suffusion of countenance and lessened swelling of fingers. No marked change.

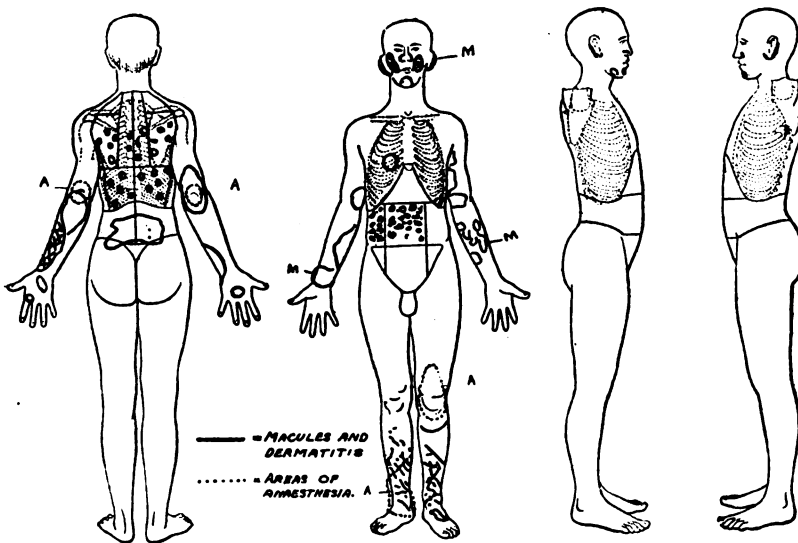
Case IX.

A. R., age 15, male, Filipino; occupation, student. Born at Maragondon, Cavite. Admitted to San Lazaro Hospital February 16, 1912. Placed under treatment in this series on February 21, 1912.

Family History.—His father and mother, two sisters, and four brothers living and well. States he has a cousin in Malabon who has leprosy, but denies association with him.

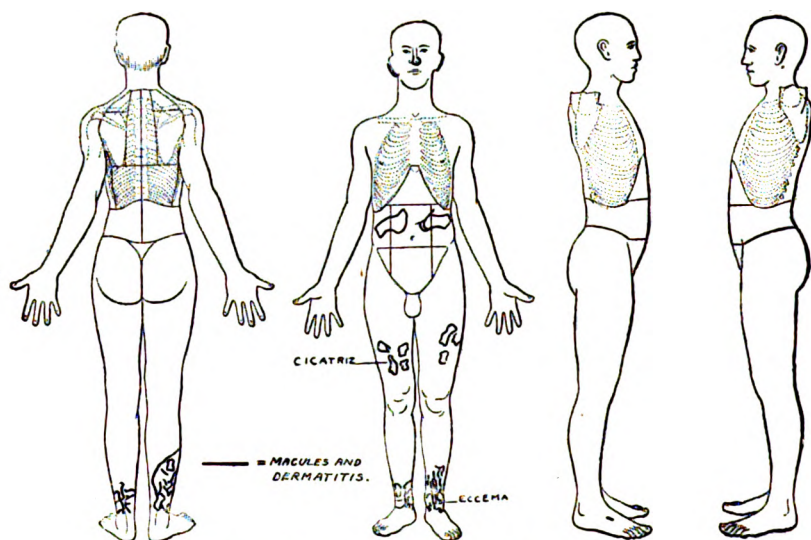
Personal History.—Habits regular. Smokes moderately. Has eaten rice and fish daily; meat about once a week.

Present Illness.—He had scabies at 7 years, several months after which red spots began to appear on his chin, and later red spots appeared on other parts of his body.



CASE IX.—Diagram made February 21, 1912, showing distribution of lesions.

Present Condition.—Eyebrows very thin. Edge of nostrils is red, hard, and indurated. There is a superficial scar on the chin which he states is due to a burn. His cheeks are reddish and have some wrinkles, which are due to knife cuts he received as a boy. The lobes of the ears are enlarged, red, and thickened. The abdomen is covered with small white spots alternating with rosy, shining spots. Similar lesions are found across the back. In the sacral region there is a large irregular macule, dark



CASE IX.—Diagram made April 15, 1914.

brown in color. Numerous macules on arms and legs. Loss of sensation on the outer part of the arms and legs. The distribution of the lesions is well seen on the preceding diagram.

Diagnosis.—Hypertrophic leprosy, microscopically confirmed.

Treatment.—February 21, 1912, 1 c. c. of chaulmoogra-oil mixture injected into the buttocks every eight days. Dose gradually increased to 4 c. c. During July dose increased to 5 c. c. During October the dose was gradually reduced to 1 c. c. and at intervals raised to 4 c. c. Beginning January, 1913, doses varying from 1 to 4 c. c. were given every three days. Beginning February, 1914, 2 c. c. have been injected every three days.

Description of Lesions During Treatment.—By October, 1912, there was a distinct improvement in all the lesions, and the patient was in better general health. By November, 1913, practically all of the infiltrations had become soft and most of them had been absorbed. The swelling disappeared in the fingers, and they again became normal in appearance. April 7, 1914, the sensation over the outer part of arms and legs had partly returned. There is still clinical evidence of leprosy lesions on the chest, the ears, and face. Two months ago a large ulcer ap-

peared on the inner lower surface of the left leg. There has been little change in the eyebrows. The accompanying photograph and diagram show his present condition.

Microscopical examinations were made by the bureau of science with the following result:

Date	By Whom.	Result.
February 12, 1912.....	Drs. Mercado and Goff.....	Positive.
December 4, 1912.....	Bureau of science.....	Do.
May 19, 1913.....	do	Negative.
May 27, 1913.....	do	Positive.
April 15, 1914.....	do	Do.

Result.—Greatly improved but far from well.

Case X.

F. T. Declined to take further treatment after June 5, 1913. At that date he showed considerable improvement, but was microscopically positive.

Case XI.

M. M. Declined to take any treatment after October 28, 1912. There was some improvement in his condition.

Case XII.

E. E. Declined to take any treatment after January 5, 1913. The record shows that there was some improvement in the clinical symptoms.

Statistical Summary.

Cases placed under treatment.....	12
Cases taking treatment throughout period.....	9
Cases apparently recovered and microscopically negative.....	1
Cases in which clinical evidence of leprosy practically disappeared.....	4
Cases showing only slight evidences of improvement.....	1
Cases declining to take prescribed treatment.....	3

NET RESULTS.

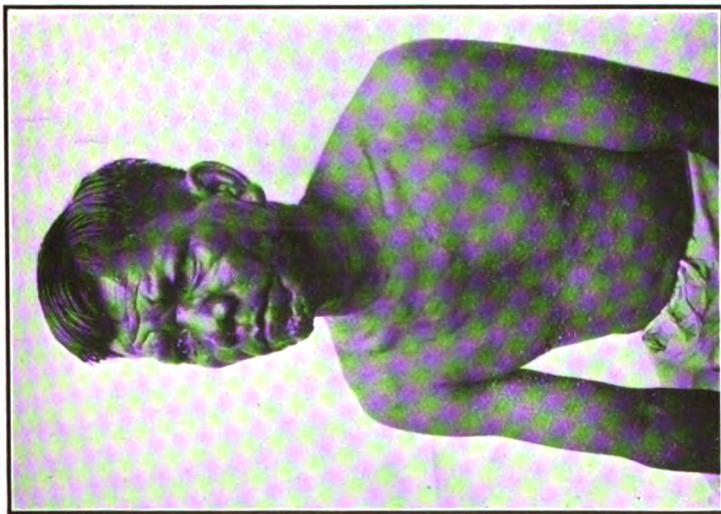
	Per cent.
Apparent cures.....	11.11
Apparent clinical recoveries.....	44.44
Showing marked improvement.....	33.33
Showing only slight evidence of improvement.....	11.11

Brief Review of the Steps Leading to the Present Treatment.

It has been customary in the Philippine Islands to try any treatment for leprosy that came to the attention of the bureau of health and in the employment of which we could satisfy ourselves that no harm would be done to the patient. We have always been very fortunate in having volunteers for any form of treatment which it was proposed to try. Most of the remedies had no noticeable effect. However, some apparent cures have resulted from time to time with the different treatments used. For instance, several lepers were apparently cured by the use of the X-ray; others were apparently cured by the administration of crude chaulmoogra oil by mouth, but regardless of the treatment used the disease always returned before the expiration of a year. In view of this experience, it was deemed advisable to wait for a period of two years before reporting apparent cures. That a period of two years, or perhaps even a longer time, should elapse before a case may be considered as cured is well illustrated by Case I. Reference to the microscopical record shows that this case was negative from May 19, 1913, to February, 1914. April 15, 1914, it was positive again, and this in spite of the fact that the physical signs of leprosy have not returned.

Chaulmoogra oil by mouth has been used at the San Lazaro Hospital since the early years of American occupation of the Philippine Islands. In 1907 our attention was directed to the success which was had by Dyer, of New Orleans, in the treatment of leprosy with chaulmoogra oil. In 1908 a conference was had with him and through his courtesy Dr. Hopkins showed us the cases that had been treated by Dr. Dyer's method at the Iberville Parish Leper Colony, as well as the practical details for administering the oil, the strychnine, and the sodium bicarbonate baths.

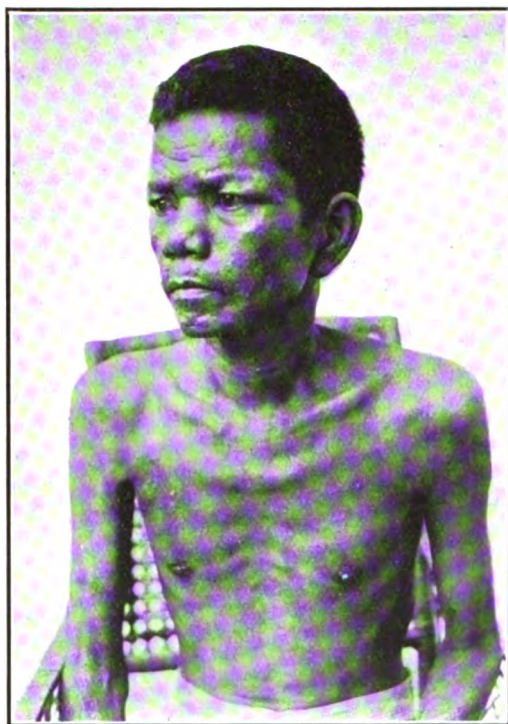
Cases were soon afterwards treated at the San Lazaro Hospital, Manila, by Dyer's method and much more success was had than formerly. Unfortunately, however, on account of the great nausea which was produced, very few cases were able to take the oil for a period of more than a few months. Every effort was then made to find a way by which the oil might be given



CASE III.—Photographed February 21, 1912. Face distinctly leonine. Whole face infiltrated, with heavier deposits in chin, ear, and nose.



CASE III.—Photographed August 19, 1912. Much of infiltration has been absorbed. Ear markedly reduced in size. Leonine expression almost gone.



CASE III.—Photographed April 15, 1914. Ear normal in size. Infiltration about face practically disappeared. Leonine expression gone.

without causing this untoward effect. Various preparations of the oil in which the emetic principle had been removed were tried, but these apparently had no influence on the disease. Emulsions of different kinds were prepared. Capsules were coated with various substances with the idea of having them pass through the stomach unaltered, but nausea continued to occur and scarcely anyone could be induced to take chaulmoogra oil for a longer period than three months on account of the nausea. The few who persisted beyond this period usually showed great improvement and a few apparent cures took place. Enemas of chaulmoogra oil were also tried, but they had no apparent influence on the disease.

A review of the literature showed that the oil had been used hypodermically. That method was then tried, but great difficulty was had owing to the failure of the oil to be absorbed. To overcome this difficulty the Merck Co. suggested that chaulmoogra oil might be combined with ether or camphor. The suggestion was put into effect and it was found that camphor gave the best results. It then occurred to Dr. Mercado, the house physician at the San Lazaro Leper Hospital, to combine the camphor with the resorcin prescription of Unna. The mixture was prepared as follows:

Chaulmoogra oil.....	c. c.....	60
Camphorated oil.....	c. c.....	60
Resorcin	grams.....	4

Mix and dissolve with the aid of heat on a water bath and then filter.

Soon after this mixture was used hypodermically over a period of several months, noticeable improvement took place in the appearance of the lesions and in the general health. The treatment was irregularly used on a number of cases. Among others, two lepers took it who had previously been treated without success with a vaccine made with bacilli grown in accordance with the method of Clegg. These two cases recovered early in 1911 after a few months' treatment and apparently remained completely cured for a period of two years, when they were discharged from the hospital on probation. Later, two additional cases recovered that had no other form of treatment except the hypodermic injections of the chaulmoogra oil mixture, from

which it seems reasonable to infer that the vaccine had had no effect in the first two cases.

Kind of Oil Used.

On account of the question raised recently in a number of medical journals as to the genuineness of much of the chaulmoogra oil on the market at present, a sample of oil was purchased in the open market of Manila and a sample of oil was secured from the Indian Forests Economic Products Co. (Ltd.), of Chittagong, India. Both of these samples were sent to the bureau of science for analysis, with the following result:

	Standard. { (at 25° C.)	Indian. (at 30° C.)	Stock. (at 30° C.)
Specific gravity.....	0.951	0.9466	0.9543
Ref. index.....	1.478	1.478	1.478
Sap. number.....	213.0	212.9	216.0
Hanus iodine No.....	103.0	102.2	103.5

There is little choice, both oils being close in their constants to the standard oils.

A. H. WELLS, Analyst.
H. C. B.

The oil used in the treatment of the cases reported in this paper was that referred to in the foregoing analysis report as "stock."

Experience with chaulmoogra oil at San Lazaro Hospital, when administered by mouth, has shown that the crude oil is much more efficacious than the refined product. When used hypodermically, there is apparently no difference whether the crude or the refined oil is used, but accurate data with regard to this point are not yet available.

Details of Treatment.

The injections are usually made at weekly intervals in ascending doses. The initial dose is 1 c. c., and this is increased to the point of tolerance. Much difference exists among the cases as to the amount of the mixture which they are able to take. In some cases a few cubic centimeters produce marked reactions in the lesions, accompanied by fever and cardiac distress. Sometimes it is better to reduce the amount of the dose and inject

at more frequent intervals. The object sought is so to regulate the dose as to prevent reactions of too violent a character. Quicker results are also apparently obtained when it is possible to inject the mixture into large leprous deposits or to divide the dose by injecting it into a number of smaller infiltrations. Experience so far leads to the inference that with additional study the prospects seem fair for greatly improving upon the results that are obtained at present. Attention is drawn to the fact that no strychnine was used. Many writers have regarded strychnine as an essential part of the chaulmoogra oil treatment. Saline purgatives are freely employed. Two per cent hot sodium bicarbonate tub baths are prescribed every other day. Those who take prolonged baths regularly seem to improve more rapidly than those who do not.

Scabies and Leprosy.

Attention is drawn to a point in the foregoing histories: Of the nine cases under discussion five, or 55 per cent, were afflicted with scabies prior to the appearance of the leprous lesions. The writer has had an opportunity to examine over 8,000 cases of leprosy, and while he has had no accurately recorded data to cover this point in all of the cases, yet he has often been struck with the frequency with which cases of leprosy either have scabies at the time the patients come under observation or who give histories of having had scabies.

Conclusion.

The present stage of the development of the treatment herein described does not warrant a claim that anything like a specific for leprosy has been found, but experience does show that it gives more consistently favorable results than any other that has come to our attention, and it holds out the hope that further improvement may be brought about. It produces apparent cures in some cases, causes great improvement in many others, and arrests the progress of the disease in almost every instance. We have on hand at present over 20 persons who have become microscopically negative since they began the treatment. The treatment is apparently equally efficacious in all forms of the dis-

ease; that is, the tubercular or hypertrophic, the anæsthetic, and the mixed. A series of cases is now undergoing the treatment for the purpose of more accurate study of its effect in the different forms of the disease and whether any difference exists as to sex. Experience also shows the great desirability of further trial in the hands of other workers in different parts of the world, with the hope that improvements may result. Finally, it is always important to remember that there are many treatments for leprosy which apparently cause some improvement, and it not infrequently happens that when cases of leprosy are placed under better hygienic conditions and have hospital care, or for other reasons not understood, the disease is often arrested, in a few instances improvement results, and that apparent cures may take place without any treatment.

THE BACTEREMIC NATURE AND LABORATORY DIAGNOSIS OF LEPROSY.

By

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and

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Since the discovery of *Bacillus lepræ* by Hansen in 1879, as the cause of leprosy, it has been a common occurrence to find this microörganism in sections from the nodules or other lepra lesions.

In recent years attention has been given to the fact that *B. lepræ* is also found in the nasal secretion of persons affected with leprosy, and this has been considered of value in the laboratory diagnosis of the disease.

The common finding of *B. lepræ* in the juices from lepra nodules, by numerous writers, has given rise to the belief that the microörganisms may possibly exist in the blood, and based on this, Stephan,¹ in 1896, reported a case of maculo-anesthetic leprosy, in which *B. lepræ* were found in the blood smears made from the lesions as well as from healthy parts of the skin.

Stephan's investigation was limited to the examination of blood smears; the blood was obtained by pricking the skin in different parts of the body. Sixty blood smears in all were made; thirty from apparently healthy parts all over the body, and extremities, and thirty from macular or anesthetic regions of the skin. Lepra bacilli were found in all preparations.

Deutrepont and Walters (*Arch. f. Derm. und Syphilis*, 1896, heft. I) found a considerable number of *B. lepræ* in the pericardial fat of a case dead from leprosy.

Boston and McFarland of Philadelphia have reported in recent years the finding of *B. lepræ* in the blood of lepra patients in smears made from the finger blood. The organism being

1. Stephan, Karl: Inaugural Dissertation, Kaiser Wilhelm Universität, Strassburg, 1896.

described as free in the serum or phagocytized by polynuclear leucocytes.

The results of these authors do not eliminate the possibility of contamination of the apparently healthy parts of the skin by the nearby affected area through scratching or some other means, or by other acid fast organisms than *B. lepræ*. Moreover, although they have neglected the examination of the blood directly from the vein, and the description of *lepra-cells* in preparations (an important characteristic of leprosy), their work, nevertheless, we believe to be an additional evidence of the bacteremic nature of the disease.

It was through an attempt to cultivate the *B. lepræ* in artificial cultures that the writers had the opportunity to observe the presence of the organism in tubes inoculated either with fragments or the juices from a lepra nodule, from blood obtained by scarification of the lesion or by puncturing the finger as well as with the blood of the patient directly obtained from the vein.

A man from the South, about 40 years of age, came to us in April, 1912. On examination the lobe of the left ear was found somewhat swollen and presented a suspicious tubercle in that region. For obvious reasons the nodule was not removed and our researches were limited to the examination of the nasal secretion and a few drops of blood collected from the lobe of the ear and finger. Blood smears were made and examined for the presence of acid fast bacilli and also, and under aseptic precautions, the blood was inoculated on trypsinized egg medium.²

To our surprise, *B. lepræ* were found so abundantly in the blood smears, as well as in the blood cultures from the nodules, that the possibility of this organism being in the blood was suspected.

But as the mere finding of *B. lepræ* in the blood from the nodule or from the finger, did not exclude the possibility of the organism being actually derived from other sources than the blood, it was desirable to make a further investigation.

Through the courtesy of the medical staff of the Municipal Hospital of Philadelphia we had the opportunity to examine two more lepra cases. The patients were both females, about

2. *New Orleans Medical and Surgical Journal*, October, 1912, Vol. 65.

forty to fifty years of age; the one presenting the characteristic lesions of tubercular leprosy and the other a somewhat fixed form of the disease.

Our research was especially concerned with the examination of the blood. This was collected, under aseptic precautions, from the nodules and from the tip of the little finger, which, in each case, was absolutely free from any visible lesion, and blood smears and blood cultures made.

On examination, although *B. lepræ* were abundantly seen in the blood smears from the nodule, it was only after a long search that a few microorganisms were found in the blood smears from the little finger. In the cultures, likewise we succeeded in finding few *B. lepræ*, in the trypsinized egg medium inoculated with the blood from the nodule as well as from the finger blood, after a week's incubation at 37° C.

The possibility of a surface contamination of the finger, by scratching, etc., however, did not escape the attention of the writers, and with this point of view, a new sample of blood was collected, under rigid aseptic precautions, from the great toe, which, in each case, was absolutely free from any visible lepra lesion, and blood smears and blood cultures made as before. The result was practically the same as the one obtained with the finger blood.

But an absolute proof that the *B. lepræ* found in the blood actually originated from the blood and not from the tissues or other source of contamination would be findings of this micro-organism in the circulating blood. The blood was drawn by the aid of a syringe from the vein of the forearm and treated as before. *B. lepræ* were found in the smears as well as in the cultures made from the blood collected in this manner.

In regard to the artificial cultivation of *B. lepræ* our results have not been satisfactory, as the culture referred to in this work in reality means more a transplantation than an actual growth of the organism under artificial conditions. We have found an increase of *B. lepræ* on trypsinized egg medium after some days incubation at 37° C., but whether this increase is only apparent and due to the setting free of the numerous bacilli enclosed in the lepra cells or to a temporary actual growth upon

the juices or cells of the body transplanted with the material, we are not prepared to say. Both conditions very likely take place, but whatever the case may be on subsequent inoculations the bacilli become gradually less numerous and finally disappear on the fourth transplantation and the medium was found sterile and free from *B. lepræ*.

The results of our investigations bring us to the consideration as to the value which the presence of *B. lepræ* in the blood may be in the laboratory diagnosis of the disease.

Among the methods usually emphasized in the laboratory for the diagnosis of leprosy we have: the finding of *B. lepræ* in spreads or sections made from the nodule and the finding of *B. lepræ* in the nasal secretion. To this, in the light of our result, may be added a third, the finding of *B. lepræ* in the blood.

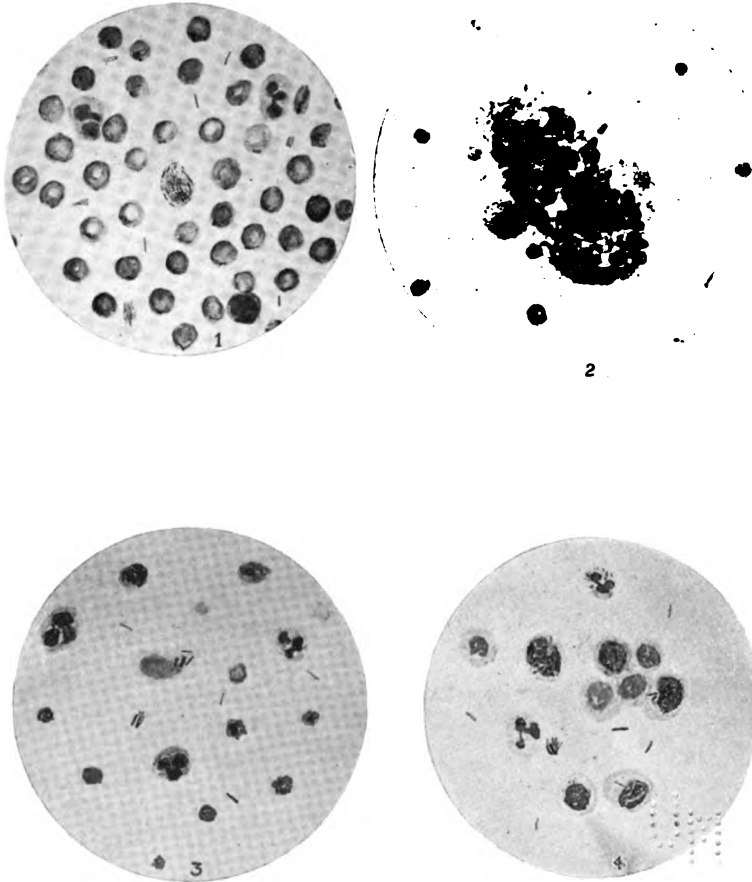
1. *B. lepræ* in the Nodule.

The suspected nodule is incised and the serum or bloody exudate collected. Spreads are made and stained as for tubercle bacilli or the nodule is removed wholly or in part and sectioned in the usual way. The sections are stained by carbol fuchsin, decolorized by acid alcohol and counter-stained with methylene blue as for tubercle bacillus. *B. lepræ*, like tubercle bacillus, is acid fast, but is differentiated by the fact that while the tubercle bacillus is usually found in isolated tubercles, *B. lepræ* is usually diffused in the cellular tissue. The giant cells in cases of tuberculosis and lepra cells in cases of leprosy will aid in the differential diagnosis.

We have found the frozen section method to give the best results. The section is put on a slide, and fixed to it by a film of thin celloidin by carefully dipping the slide in thin celloidin, fixed with 4% formaldehyde, washed and stained in the usual way.

2. Examination of Nasal Secretion.

With the aid of a swab, as usually done for diphtheria, the material is collected from the nasal mucosa and smeared on a slide or cover glass. The preparation is dried, fixed and stained as for tubercle bacillus. *B. lepræ* is more apt to appear in



- Fig. 1. Leprosy: *B. lepra* in lepra cell. Blood smear from nodule. Direct preparation.
 Fig. 2. Leprosy: *B. lepra* and lepra cell. Finger blood preparation, acetic acid method.
 Fig. 3. Leprosy: *B. lepra* inside of lymphocyte. Blood from great toe; acetic acid method.
 Fig. 4. Leprosy: *B. lepra* free and inside of lymphocytes. Venous blood preparation; acetic acid method.

10

pairs, masses or bundles than tubercle bacillus. In case of doubt the material is injected into a guinea pig, in which tubercular lesions are the rule for tuberculosis, after a month or so, while a negative result is the rule in leprosy.

3. *B. lepræ* in the Blood.

If the blood is collected from a nodule, *B. lepræ* are easily found in the smear. The procedure consists in making a blood smear of fair thickness, drying, fixing and staining as is done for tubercle bacillus.

If the blood is collected from the finger or from the vein, 0.1 to 1.0 c. c. of the blood is mixed with 1.-10. c. c. of an acid-fast, bacillus-free, 2% acetic acid solution, respectively. The mixture is shaken to complete hemolysis of the blood and centrifuged for 10 to 15 minutes. The liquid is decanted and from the sediment smears are made. The smear is dried, fixed and stained.

This procedure enables the examination of a larger quantity of blood. In our investigation we found it of great advantage for a rapid detection of *B. lepræ* in the blood collected from the finger or from the vein.

B. lepræ is found singly, in pairs, or aggregated in masses or bundles free or intracellular. Not uncommon, typical lepra cells may be seen, or the bacillus may be found phagocytosed by an endothelial or lymphocytic cell.

Before concluding it may not be out of place here to state that this acid-fast organism found in the blood could not be traced to any possible outside contamination. The acetic acid solution was filtered, through a porcelain filter, six times, and moreover, the blood of one of the writers, and that of two other normal persons, has been repeatedly examined as controls, with negative findings in each case.

Furthermore, in the hope that the acetic acid method would possibly be of advantage in detecting tubercle bacillus in cases of tuberculosis, twelve patients were selected from the Philadelphia Hospital, each of which was found to contain tubercle bacillus in the sputum in three different examinations made. The blood collected from the finger of each patient was carefully and systematically examined for the presence of tubercle bacillus

or any other acid-fast organism. So far, we have not succeeded, to our satisfaction, in finding tubercle bacillus in the blood nor have we found anything resembling *B. lepræ* or any other acid-fast organisms. Blood cultures likewise have been unsuccessful.

In conclusion, in support of the bacteremic nature of lepra, that is that *B. lepræ* exist in the circulating blood, we have the following evidence:

1. *B. lepræ* is found in the blood collected from healthy parts of the skin which are apparently normal and from which the microörganism are usually absent on section.
2. By the acetic acid method, *B. lepræ*, either singly, in pairs, in masses or in bundles is detected in the venous blood.
3. The presence of *B. lepræ* in the form of lepra cells or phagocytosed by endothelial cells and more especially by lymphocytes in the venous blood.

And finally, (4) the apparent or actual growth (at least temporarily) of *B. lepræ* in cultures made from the venous blood may be an indication of the resemblance of leprosy to other bacteremic diseases.

MOSQUITOES AND SEWAGE DISPOSAL.

By

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and

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It is now well understood that certain species of mosquitoes, which are more or less close associates of man, multiply most rapidly in the presence of highly polluted water. This is particularly true of *Culex pipiens* and *C. quinquefasciatus*, and it may be said that their abundance is in direct relation to such breeding conditions. References to this relation are frequent in the literature, and it is hardly necessary to give citations, but its direct bearing on many mosquito outbreaks has not been sufficiently appreciated. A striking case which the authors have recently investigated appears of special interest because in it modern contrivances for sewage disposal, designed to safeguard the health and comfort of the community, have brought about the excessive multiplication of mosquitoes. The sewage disposal plants under consideration are of types that recommend themselves to smaller communities from considerations of economy, and are based upon the employment of a limited amount of piping and small water supply.

The case in question involves certain suburban communities a few miles from a large eastern city, of which the one that appeared to suffer most acutely was investigated. This we will designate by the assumed name, Hilton. It may be stated at the outset that these suburban communities are of the best type, with fine residences in spacious grounds and well-kept walks and driveways. The region is hilly and the broken topography at once indicates to the experienced eye that there are few natural facilities for mosquito breeding. Hilton itself is located on a high hill with steep slopes over which the settlement spreads out. Yet for two summers the inhabitants have suffered greatly from mosquitoes, the pests appearing literally in clouds, and, in spite of careful screening, large numbers invaded the houses.

The local Civic League took up the problem. Mosquito-breeding places that would account for such an enormous output were not in evidence in that neighborhood and thoughts naturally turned to the possibility of an influx from some remote locality. With the knowledge that mosquitoes are produced in enormous numbers in the salt marshes, and that these mosquitoes migrate inland many miles, grave misgivings arose that the source of the trouble was beyond the reach of the community.

At this stage the Bureau of Entomology was called upon for advice and the writers were directed to investigate the situation. The secretary of the Civic League submitted catches of mosquitoes made at different points in Hilton. Examination of these specimens at once disposed of the migration theory. They were without exception female *Culex pipiens*, one of the species indicated above as an associate of man and well known not to undertake extensive migrations. It was therefore obvious that the mosquito plague was of local origin and produced either within the settlement itself or in its immediate vicinity.

On July 10 the junior author made a preliminary survey, and a week later both authors went over the ground together. It developed that the primary foci of mosquito production were three systems for the disposal of sewage. In addition there were a considerable number of less important breeding places, all contributing in a greater or less degree to the total result, and, therefore, by no means negligible. These minor breeding places consisted of smaller streams, the backwater in larger, swift-flowing streams, and in some cases swamps and stagnant pools produced by obstruction of natural drainage. In every case the waters infested with mosquito larvæ were found to be polluted by sewage and the abundance of the larvæ in the individual cases was in proportion to the degree of pollution. Obviously the foulest water exercised the strongest attraction over the ovipositing females. It may be stated in this connection that two ponds, one an ornamental one near a house, the other an "ice pond" in a nearby piece of woodland, had been under strong suspicion and it had even been seriously proposed that they be drained. These ponds were found to be wholly innocent. Only a very few mosquito larvæ were found among the vege-

tation at the margins, and these proved to be *Culex territans*, a wholly inoffensive species.

As already indicated, the bulk of the mosquito breeding took place in three distinct outfits for the disposal of sewage. In the first of these systems the sewage is conducted into a series of "screen wells" just beyond the settlement, in which the gross matter is retained by dividing iron gratings. The more fluid matter which passes these screens is collected in a cesspit and pumped onto the "disposal fields," where the liquid filters through beds of sand overlying tile drains, and is then conducted into a nearby stream, while on the following day the layer of retained filth is raked off and carted away. Several of these disposal fields are used in rotation, each field being allowed several days to dry and recover its efficiency. The screen wells and cesspits were found to be prolific mosquito breeders. Larvæ and pupæ were found in the thick liquid and the adults rested on the walls and covers in large numbers. Theoretically the cesspits should be completely emptied at each weekly pumping, and were this effected no mosquito breeding could occur. However the larvæ and pupæ, at least for the most part, manage to remain behind in the pit with the inevitable residue. That some of the larvæ and pupæ are carried to the disposal field toward the end of the pumping was witnessed by one of us, but of these but few can transform to adults before the residual filth is raked together and removed. No estimate of the number of mosquitoes produced in this sewage system was possible on account of the inaccessibility of the screen wells and cesspits, but everything pointed to a very considerable output.

The second sewage disposal system gave much more positive data. This culminates in a large tank, located about a mile southeast of Hilton and close by a rapid stream. This device is of the type known as the Imhof tank, and consists of a deep circular concrete tank about thirty feet in diameter, entirely open above, and divided by concrete walls into a central chamber and six outer ones. In the central chamber the heavy substances are segregated, while in the outer chambers the more fluid matter is decomposed through bacterial action and drains slowly into the adjoining stream in a partially purified condition. The tank

is entirely open above, so that mosquitoes have free access, and the contents present a placid surface. While the liquid appeared to be of a thick "soupy" consistency, and was largely covered with scum, mosquito breeding was prodigious. The surface of the liquid was dotted with the egg-masses of the mosquitoes, and in the corners formed by the dividing walls hundreds of the eggrafts formed a practically continuous mass. We consider 5,000 a very conservative estimate of the number of egg-masses present in the tank at the time of our visit, and, as these egg-masses average 200 eggs each, they indicated a daily output of about 1,000,000 mosquitoes during the summer. Of course only a part of the immense numbers of mosquitoes bred from this tank find their way to Hilton; the other residential sections in the vicinity no doubt attract their proportion of the hungry females. In fact, a large apartment house only a few hundred yards from the Imhof tank suffered greatly from the mosquitoes. However, it seems not unlikely that the favorable topography and the attraction of a larger number of inhabitants may bring a larger proportion of the mosquitoes to Hilton. In this connection it must be pointed out that this Imhof tank has been in operation two years, and that the mosquito plague in Hilton has extended over the same period. It may be assumed that the female mosquitoes are, on the one side, strongly impelled to procure their blood meals, and, on the other, having matured their eggs, are strongly attracted to these optimum breeding places. Thus their existence is bound up in the two food supplies furnished by man, his own blood for the females, his waste products for the larvæ.

The third sewage disposal plant is situated at about an equal distance from Hilton as the Imhof tank, but in the opposite direction. It relieves a distinct community of its sewage and is located in a narrow valley, near a stream. Here the sewage is conducted into a great concrete tank, which covers an area of one hundred and forty feet by sixty feet, and is twenty-six feet in depth.* It is roofed over with concrete, into which is set a series of iron-covered manholes. The iron covers are

*These measurements include two units, as they are termed, only one of which is in use. Therefore the effective dimensions at present are about one hundred and forty feet by thirty feet by twenty-six feet.

supplied with small ventholes which give the mosquitoes access to the sewage below. Inside the tank the sewage undergoes nitrification through bacterial action and finally discharges into the stream in a much purified condition. This tank furnishes ideal conditions for mosquito breeding and the larvæ were found in the sewage, while above it great numbers of the adults rested on the sides of the inner partition walls. Circumstances did not permit an estimate of the number of mosquitoes produced by this tank, but the indications are that it must be immense. That a large proportion of these mosquitoes find their way to Hilton, about a mile away, seems probable, when one considers that the sewage tank is in a valley and that the mosquitoes have a tendency to progress up the hillsides.

Returning now to the lesser sources of mosquito production, these were found in every case polluted by sewage. The presence of the larvæ in relation to sewage could be followed readily in the case of the streams, where the mosquito breeding was augmented wherever sewage was discharged into them. The stream in the vicinity of the Imhof tank was a particularly striking case. This stream has a swift current, but is strongly polluted, not only with the discharge from the tank, but also by other sewage discharging directly into it. Here the *Culex* larvæ could be found wherever an obstruction in the stream gave sufficient protection against the swift current. The occurrence of these larvæ in the rapid stream was quite contrary to ordinary experience with *Culex pipiens*. A short distance down the stream, where the water had become considerably purified, no larvæ could be found, even in the most sheltered situations.

With reference to the control of mosquito breeding, the sewage disposal systems discussed, and similar ones elsewhere, present an interesting problem. The underlying principle in these different systems is the bacterial reduction of the sewage, so that the water may be finally discharged in a purified and inoffensive condition. In the case of the Imhof tank, thorough treatment of the surface with oil will control the mosquitoes and presumably will not interfere with the processes in the liquid beneath; perhaps it will even favor them. But in the case of the large covered tank last described, treatment with oil

is made impossible by a considerable current at the surface of the liquid contents. The application of a miscible larvicide, like that of the Isthmian Canal Commission, is out of the question because it would arrest the bacterial reduction process. The Bureau of Entomology is now seeking a solution of the problem and hopes to find some means of destroying the mosquito larvæ that will not conflict with the function of the sewage purification tanks.

NEWS AND COMMENT

Greenville, S. C., has placed pellagra and malaria on its list of reportable diseases.

The Swiss government has declared a quarantine against Russia, Servia, Austria and Galicia, on account of cholera.

It is said that 120,000 packages of cholera serum have been received from Vienna, and troops at the front are being inoculated.

Dr. R. T. Shields, dean of the Medical Department of Nan-king University, has returned to China after some time spent in this country.

A test station will be established at Blissville, Ark., by the United States Public Health Service for the observation of malaria and hookworm.

Dr. G. M. Guiteras, surgeon in the United States Public Health Service, has been relieved from duty at Havana, Cuba, and has returned to the Marine Hospital, Key West, Fla.

Dr. M. Bruin Mitzmain has gone to Pee Dee, N. C., to join the members of the United States Public Health Service who are investigating malaria in that vicinity.

The meeting of the Canadian Public Health Association, to have been held in September, in Port William and Port Arthur, Ontario, was canceled on account of the war.

Dr. Victor G. Heiser, surgeon in the United States Public Health Service and Health Commissioner of the Philippine Islands, has returned to Manila after several months spent in the United States.

Dr. C. H. Mohr has been authorized by the City Commissioners of Mobile to expend as much as \$50,000 in cleaning up the city and ratproofing buildings and wharves.

Dr. Paul B. Clark of the Rockefeller Institute of Medical Research will succeed Dr. Mazyck P. Ravenel as associate professor of bacteriology in the University of Wisconsin.

Dr. A. J. McLaughlin, surgeon in the United States Public Health Service, has been granted a leave of absence for six months and will serve as sanitary expert with the International Joint Commission.

An epidemic of cholera is reported from Manila, the first in twelve years. There were at the time of the report said to be one hundred cases with fifteen deaths, all among natives.

Because of the cholera in Europe, boarding quarantine officers of the Port of New York have been instructed to inspect thoroughly all vessels, crews and passengers from infected ports.

Thirteen out of thirty-four deaths in August at the State Hospital for Nervous Diseases, Little Rock, Ark., were from pellagra. More than seventy-five inmates are said to have the disease.

Dr. Allan J. McLaughlin has resigned his commission as surgeon in the United States Public Health Service and has accepted the position of State Commissioner of Health of Massachusetts.

Forty-five thousand injections of antityphoid vaccin were required for the Canadian troops in camp at Valcartier. Out of this number, no cases of severe reaction nor infected arms were reported.

Dr. W. A. Sawyer, director of the California State Hygienic Laboratory, has received the appointment of lecturer on hygiene and preventive medicine in the University of California Medical School.

In most of the coast towns of Florida rat campaigns are being carried on. The negro longshoremen of Tampa amuse themselves while waiting for ships by catching rats, for which they receive 5 cents each.

The thirtieth case of human plague in New Orleans has occurred in a Chinaman, who was taken to the hospital on Oct. 4. He died four hours afterward with right femoral bubo. This is the ninth death from the disease. No new human cases have occurred since and no rodent cases have been reported since Oct. 19.

Since commencing its work in Arkansas four years ago, the Rockefeller Hookworm Commission, with Dr. Charles W. Garrison as state director, has made 49,961 examinations at a cost of \$60,000, and has found 10,000 cases of infection.

Dr. Frederick P. Gay of the University of California delivered the first Harvey lecture of the year at the New York Academy of Medicine, Oct. 10. The subject was "Experimental Studies on Methods of Antityphoid Immunization."

A banquet was given recently in Switzerland in honor of Dr. Schmid, for twenty-five years head of the Public Health Service in that country. To Dr. Schmid belongs the credit for the present excellence of the Swiss Public Health Service.

The American Social Hygiene Association and the Society of Sanitary and Moral Prophylaxis held a joint conference in New York City on Oct. 9. The program included addresses on the church and its organization, departments of health, social hygiene in relation to departments of public health, education, etc.

The Iowa Department of Health is distributing broadcast a button containing an epigram made sometime ago by Gov. Clark: "The health and happiness of the people are paramount to every other issue." The department is using this as one means to arouse and strengthen the interest of the public in the importance of health.

The Philadelphia Child Federation will place signs in conspicuous places, giving instruction to mothers for the care of their children. Three hundred iron frames will be erected in alleys, courts and public squares, where they will be most easily seen. Signs containing such information as is deemed best will be inserted from time to time.

Dr. George H. Whipple, formerly of the Johns Hopkins Medical School, has been appointed director of the George Williams Hooper Memorial Foundation for Medical Research in the University of California, and Doctors Ernest Linwood Walker and Carl Friedrich Meyer have been appointed associate professors of tropical medicine. Dr. Charles W. Hooper will be fellow in research medicine.

On account of the battle of the Marne, fear was felt for the continued purity of the water supply of Paris. The battlefield has been gone over carefully and every sanitary measure possible enforced. The drinking water of Paris is being tested several times a day, and at the first suspicion of contamination the water of the Seine and the Marne will be made available by the addition of hypochlorites.

The report of Dr. Joseph O'Connell, health officer of the Port of New York, shows that no case of quarantinable disease has been admitted to the city during the present year. There have been 57 persons with such diseases removed from ships, and 4342 who have been exposed were held for observation. Twenty cases of typhoid were removed from 13 ships, with 18 recoveries. Nine hundred and ninety-seven ships have been fumigated for the destruction of rats.

Pamphlets have been distributed among the Australian expeditionary force, giving simple rules for preserving the health while on field duty. Personal cleanliness, camp hygiene, the necessity for drinking only boiled water, means of preventing infectious diseases, and other similar topics, are taken up. While it is not thought that this will entirely prevent outbreaks of

diseases common to armies, it is believed that some benefit will be derived by the men.

A test case has been made of a Chicago moving picture show, the proprietor of which was found to be violating the ventilation laws. The order to remedy this was met with refusal, and the picture show was closed by the Health Department. An injunction was obtained to prevent the city's interference with the operation of the theater until the case could be tried. The court decision, however, sustained the action of the Health Department in closing the theater.

Four new sanitary dairy refrigerator cars have been installed by the Baltimore and Ohio Railroad to carry milk between Ohio points and Pittsburg. The inside of the cars is white enamel and even in extremely warm weather only one icing is necessary to preserve the contents at an even temperature for forty-eight hours. Both railroad and health officials who have inspected the cars pronounce them far superior to any milk refrigerating cars heretofore constructed.

Disease Prevention Day, held in Indiana on Oct. 2, was a great success. In Indianapolis a street parade was held which was received enthusiastically by the enormous crowds assembled. The schools were closed for the occasion and merchants, school children, societies and the general public worked together for the success of the day. This was true not only in Indianapolis, but throughout the state. It is to be hoped that Indiana's tremendously successful Disease Prevention Day will not only greatly benefit that state, but will be an example which other states will follow.

Before this number of the *Journal* appears, the annual meeting of the Southern Medical Association will be held in Richmond, Va., Nov. 9 to 12. There will be four sections, each meeting separately—Surgery, Medicine, Hygiene and Preventive Medicine and Eye, Ear, Nose and Throat. There will be three joint meetings. Among those addressing the various

assemblies will be Dr. Stuart McGuire, president; Dr. W. S. Thayer, Surgeon General Blue, Surgeon General Gorgas, Dr. Harvey W. Wiley and Dr. W. L. Rodman. The papers to be read promise to make the meeting one full of scientific interest. The social side will not be neglected, however, for the well-known hospitality and charm of this Southern city are sure to be long remembered by all who attend.

Public Health Activity.

Child Betterment, October, 1914. Thirty-five newspaper clippings are given telling of children having eaten or drunk fly poison. Arsenic is the basic principle of most of these poisons, and they are, therefore, far more dangerous than is generally realized. In most of the thirty-five cases, five of which were fatal, liquid poison was placed in saucers and other receptacles in the house and the children drank the contents of the saucers.

FLORIDA.—(*Health Notes*, September, 1914.) There is given herein a little story entitled "The Young Mother and the Fat Hog." A young woman of twenty-five, mother of three little girls, after a period of ill-health, became aware that she was suffering from tuberculosis. Being poor, she wrote the Board of Health, setting forth her condition and her desire to recover before the disease had progressed too far. They replied that they were powerless to aid her, but would care for her children in an orphan asylum after her death. So the little mother died and the children were taken to the orphan asylum.

A farmer one morning found one of his big, fat hogs suffering from cholera. A telegram to the Secretary of Agriculture brought a quick reply, and within a short time a government expert arrived at the farm equipped with the necessary material for treatment. The hog, of course, recovered.

The story ends with, "Moral: Be a hog and be worth saving."

MISSOURI.—(Monthly Report of the Hospital and Health Board, Kansas City, August, 1914.) This bulletin contains a summary of the work done by the Child Hygiene Department.

The prenatal clinics were well attended. While the department has not furnished pure milk to mothers for two years, instruction was given in the sterilization of milk so that the mothers themselves could attend to its purity. In case the mother's milk failed, or was insufficient for the child, the department urged the use of goat's milk. A goat may be purchased at \$5. In this way the milk will be cheap, clean and fresh. The work of the nurses and physicians is in the poorest district of the city, and principally among foreigners, many of whom are hucksters. The children may often be seen eating cucumbers, skin and all, and over or under ripe fruit. The relation of diet to health is, therefore, a very necessary part of the instruction given by the social workers.

NEW YORK.—(Weekly Bulletin of the Department of Health, City of New York, Oct: 17, 1914.) The progress in public health work has been so rapid within the last few years, and the duties of the workers are so varied, that it is difficult for them to keep pace with the new methods and ideas. For this reason a lecture course will be given for the employees of the health department. The lectures will be divided into four courses, as follows: (a) Course for Medical Inspectors and other Physicians Employees of the Department; (b) Course for Lay Inspectors (food and sanitary); (c) Course for Hospital Nurses; (d) Course for Field Nurses (infectious diseases, child hygiene). The public is invited to attend all lectures except those given at the Hospital for Contagious Diseases.

VIRGINIA.—(Health Bulletin, October, 1914.) In going over the health bulletins issued by most of the cities and states in this country, it is a glaring fact that many of them are of no interest nor benefit to the general public. Statistics form the large part of their contents, and while statistics are of interest to some, the majority of lay minds absolutely fail to grasp their significance. For that reason, the Virginia Health Bulletin stands out above the bulk of the health reports as eminently practical and useful. This month it is entitled "The Sanitary School." From first to last the information is direct and simple. It is really a textbook on school sanitation and ventilation and disease prevention sifted down to a few pages.

CURRENT LITERATURE

THE "UNDULATORY" FEVER OF THE MEDITERRANEAN IN THE REGION OF CEUTA-TETUAN.—(*Revista de Sanidad Militar; La Prensa Medica*, Havana, June 15, 1914). Dr. Estanisloa Cabanes, military surgeon, writes on the Mediterranean fever ("undulatory fever") as observed in the region of Ceuta and Tetuan. This fever is very frequent in that region, much more so than is commonly supposed, for many cases diagnosed as paludism that do not yield to quinine and others that look like infections of the digestive apparatus, are really cases of Mediterranean fever.

In the Ceuta-Tetuan region there is paludism of the typical sort, which yields to quinin and which arises in certain well-known localities. Also, there are digestive infections: Mild enterocolitis, accompanied by profuse diarrhea and little or no fever; gastro-enteritis, frequently extending to the biliary passages and causing jaundice, and yielding to appropriate treatment in about eight days; and typical typhoid fever, which is always grave. In addition to the above fevers, there is the Mediterranean fever, which is important on account of its frequency. The fever is caused by goat's milk, derived from animals that are indisputably infected. In the Ceuta-Tetuan district, there are, doubtless, many goats infected with Malta fever which come from Malta or other infected regions, or native kids that acquired the disease from imported goats. At least 90% of the cases drank unboiled goat's milk; the remainder drank goat's milk, but did not give a clear history of using raw milk. One solitary case, infected in Tetuan, declared that he had used only condensed milk. Dr. Cabanes does not believe that there is any other food capable of transmitting the disease and does not believe that cheese can carry it.

The disease attacks the civilian as well as the military population and shows no predilection for any age (except that very old persons seem to be exempt) or sex or recent arrivals in the country.

The symptomatology varies somewhat. In some cases, the disease runs a typical course, but this is rare. We are here dealing with a disease which enjoys the unique peculiarity of being baptized with the name of every region in which it has been found (Malta fever, Gibraltar fever, Barcelona fever, Valencia fever, etc.), and this can be easily understood when we remember that the disease never presents the same aspects in different localities. Dr. Cabanes describes it as it is met with in Ceuta-Tetuan. He observed cases of great intensity, of medium intensity and light cases; and these differed so much from one another that if it had not been for the course of the fever (not its intensity) and bone pains or neuralgias common to all cases, they could not have been ascribed to the same cause without resorting to laboratory methods. They were veritable clinical forms.

In the light forms, the clinical picture is reduced to a slight fever, but with a definite course, and accompanied by rheumatoid pains or neuralgias, which are usually mild; and sometimes there is headache. The temperature rises to 37.5° or 38° C. and lasts for about five days, and then becomes normal. The fever lasts only about twelve hours each day, beginning late in the afternoon and lasting until the following morning, when the patient has a profuse sweat. The patient is free from fever for three days, and then it returns and lasts for eight days again. In some cases there is another febrile relapse, in which the temperature goes up to 38° C., but does not last as long as before. In the periods of apyrexia, there is sometimes a little tachycardia. In the current (continuous) form, the temperature goes up to 39° C. on the third or fourth day and remains at that point for about twelve days, with a morning fall of about 1° ; then there is apyrexia for four days, then a fresh rise in temperature, followed by a period of apyrexia, and generally there is a third relapse. The fever is usually accompanied by headache; but chiefly there are rheumatoid pains in the bones and joints and also neuralgial (trigeminal, intercostal, sciatic). Not rarely there is a sensation of cold, and abdominal pains are not absent. Constipation is the rule. Sweating occurs at about sunrise. The patients are pale and the disease leaves a profound anemia. The spleen is hypertrophied.

In the intense forms, the temperature quickly rises to 40° and even to 40.5° or 41° C., and the first febrile stage is prolonged (about twenty days), with a continued fever in the beginning, but later becoming remittent and then irregular; then there is a apyretic period lasting from four to ten hours, followed by a new febrile relapse in which the temperature rises as high as before, but is not so prolonged; then a new apyretic period and a new febrile period, with a total duration of the disease of from three to four months. There is great hypertrophy of the spleen and profuse night sweats. The tongue is thickly coated in the beginning of the disease and in the first half of the first febrile period, and after that is perfectly clean. Neuralgias are frequent. It is particularly interesting to note, in these intense forms, the facility with which a relapse may occur after the disease has passed off, and for a month or two afterward. The physician should warn his patient about this. Sometimes it is a promenade, some fatigue, a slight chilliness or indigestion which, capable in themselves of causing a little fever that may bring on an intense febrile period lasting from twenty to thirty days.

The prognosis is unfavorable, for, although the author has never seen a case terminate unfavorably, still the neuralgias and rheumatoid pains are very distressing. Both of these are persistent and if they are localized in the lower extremity they prevent the patient from walking about and interfere with his rest. The duration of the disease, the anemia that it leaves behind and the general exhaustion of the patient compel us to realize that the disease is not a trivial one. Only the light forms allow the patient to go about his usual work; but even in these he is not exempt from neuralgia that may last a long time. Indeed, the patient is never sure that he is free from it, and at times it constitutes for him the only symptom of a disease that has almost passed unperceived.

The treatment that gives the best results consists, for the light forms, in appropriate and easily digested food, walking in the open air when the sun is shining, and, internally or hypodermically, five centigrams of arrhenal a day. The arrhenal is administered for twenty days, then suspended for ten days; this

alternating plan is kept up for three months. In cases of moderate or great intensity, while the tongue is coated, boiled milk should be given, either pure or mixed with an equal volume of some natural alkaline mineral water. Broths may be given and other foods that are well tolerated. When it is remembered that the disease causes profound anemia and emaciation, it is evident that the patient should be suitably fed. The diet should consist of soups, purees, semmola or tapioca, white fish, eggs, roasted meat and tender greens, bread, confections or fruits, and wine, if the patient has been accustomed to it. When constipation exists, laxatives should be given; the bowels should move at least once a day. Internally, arrhenal should be administered, five centigrams a day. The arrhenal combats the anemia and seems also to have some specific effect on the disease. For the relief of the arthralgias, ostealgias and neuralgias, aspirin gives the best results. In very bad cases, removal to a dry climate may be necessary.

McShane.

EXPERIMENTAL TRANSMISSION OF MEDITERRANEAN FEVER TO RATS BY MEANS OF INFECTED FLEAS.—(*Atti della Reale Accademia de Lincei*, April 6, 1913; *Archiv für Schiffs und Tropen-Hygiene*, Heft 5, 1914). Dr. Carlo Basile took 200 fleas from a dog badly diseased with kala-azar and fed them on a new-born dog. The fleas were then isolated and their feces examined. In this way it was demonstrated that Leishmanic infection existed in three fleas. These were cut into pieces and from the fragments of their bodies an emulsion was obtained that contained numerous Leishmanias. This emulsion was injected into the peritoneal cavity of white rats. These animals were killed at the end of two months and the characteristic flagellate bodies were found in the swollen spleens.

McS.

THE VIABILITY OF THE SPIROCHÆTA PALLIDA IN DIFFUSE DAY-LIGHT AT ROOM TEMPERATURE.—(*Journal of the American Medical Association*, Vol. LXII, No. 23, June 6, 1914). Zinsser and Hopkins, experimenting with the *Spirochæta pallida*, observed that the organisms, when kept in a moist medium and exposed, continue to live upward of 11½ hours; when placed on bits of towels and kept under moist conditions, positive results were

obtained up to 11½ hours also. In a third experiment, when pure cultures of the organism were placed on dry pieces of cover glasses, no cultures were obtainable after one hour's exposure. While the experiments were conducted under rather artificial conditions, nevertheless it is closely akin to the possibility of the common wash towels being able to convey an infection if moisture is present. The results command due hygienic interest, for the less common methods of the transmission of syphilis are as yet puzzling in the majority of instances and any light thrown upon the subject is welcome.

P. L. Querens.

TINEA CAPITIS TROPICALIS IN THE ANGLO-EGYPTIAN SUDAN.—Chalmers and Marshall (*Jour. Trop. Med.*, 1914, XVII, 257) describe a variety of tinea capitis tropicalis which they observed in Omdurman and Khartoum. The patients were all male Sudanese between 10 and 16 years of age. The scalp of the patient infected with this variety of ringworm presents one or more white patches composed of white scales, normal hairs and hairs broken off about one m.m. above the surface of the skin. If one of the broken hairs is removed and examined, after soaking in 40% caustic potash for several hours, rows of spores may be seen inside of the shaft of the hair; but none are to be seen in the sheath of the hair or in the cortex. The rows of hyphal segments divide dichotomously. After staining with Adamson's method (the details of which are given), the hyphal segments can be seen well in the superficial layers of the epithelium of the scalp, or inside the shafts of the hair. The organism grows well at 20° C. and 34° C., and quickly at 37° C., but not so well at 40° C. It does not grow under anaërobic conditions. It is advisable to begin cultivation in an acid, liquid medium, such as beer wort, and later to subculture into glucose peptone containing 4% of sugar and 1% of peptone, or in ordinary bouillon with —10 reaction. In all of these media it grows in the form of puffballs, with a distinct center from which the hyphæ radiate. Milk is not coagulated and it forms neither acid nor gas in any of the carbohydrate media in which it was grown. It can be cultivated on solid media, but it is difficult. Negative results have been obtained upon inoculating monkeys, cats, dogs and white mice, directly from the

patient's head and from cultures. The organism is known as *Trichophyton currii*. It belongs to the class *Fungaceæ*, to the family *Gymnoascaceæ*, Zopf, 1885, and to the genus *Trichophyton* Malmsten, 1848, and to that division of the genus called *Endothrix*. The paper gives elaborate differential characteristic tables. The following organisms are at present recognized as causal agents of tinea capitis tropicalis:

Genus *Microsporum* Gruby, 1843. (1) *M. audouini* Gruby, 1843, found in Brazil, Senegal, the Western Sudan and Madagascar. (2) *M. fulvum* Uriburu, 1907, found in the Argentine.

Genus *Trichophyton* Malmsten, 1848. (1) *T. circinvolutum* Sabouraud, 1909, found in the Senegal and Dahomey. (2) *T. exsiccatum* Uriburu, 1909, found in the Argentine. (3) *T. polygonum* Uriburu, 1909, found in the Argentine. (4) *T. sabouraudi* R. Blanchard, 1895, found in Brazil. (5) *T. sudanense* Joyeux, 1912, found in the Western Sudan. (6) *T. violaceum* Bodin, 1902, found in North Africa. (7) *T. violaceum varietas decalvans* Castellani, 1905, found in Ceylon.

The disease is not very contagious, although it is well known to the sharper small boys of the school, who call it "gouba." So far as the authors have been able to determine, it does not affect adults. The principal diagnostic points are: (1) the white, scattered, scaly patches on the scalp, which, after the white scales have cleared away, (2) show the black-dot appearance due to the stumps of the broken hairs; and (3) the absence of all signs of inflammation. After the infective stage has disappeared, small alopecial patches may be left, which must be distinguished from similar patches due to favus. These patches are small and hardly noticeable, and, therefore, the prognosis as regards baldness is good. Tobacco soap has given the best results in treatment. As prophylactic measures, a periodical inspection of all scholars for parasitic diseases and prompt treatment for those cases found are recommended.

John M. Swan.

THE SYSTEMIC POSITION OF THE GENUS *TRICOPHYTON*, MALMSTEN, 1845.—Chalmers and Marshall (*Jour. Trop. Med.*, 1914, XVII, 289) present an exhaustive study of the systemic position of the genus *Trichophyton* Malmsten, 1845. They conclude that

the genus belongs to the family *Gymnoascacæ* Baranetsky, 1872, which is included in either Brefeld's *Hemiascomycetes* or De Bary's *Ascomycetes*, according to the form of classification adopted by the reader.

J. M. S.

MOLLUSCUM FIBROSUM, PENDULATUM ATQUE ELEPHANTIA-CUM.—Harper (*Jour. Trop. Med.*, 1914, XVII, 291) records an interesting case of molluscum fibrosum. The disease was very extensive and is illustrated by four good photographs.

J. M. S.

THE OCCURRENCE OF STYGEROMYIA MACULOSA IN MADRAS, TOGETHER WITH SOME OBSERVATIONS ON ITS HABITS.—(*Indian Journal of Medical Research*, Vol. 2, No. 1, July, 1914.) Capt. W. S. Patton gives a good description of both the male and female of this blood-sucking muscid which possesses the peculiarity of crepuscular feeding habits.

W. V. King.

THE BEHAVIOR OF THE PARASITE OF INDIAN KALA-AZAR IN THE DOG FLEA, CTENOCEPHALUS FELIS BOUCHE, WITH SOME REMARKS ON CANINE KALA-AZAR AND ITS RELATION TO THE HUMAN DISEASE.—(*Ibid.*) W. S. Patton, after infecting a dog with the parasite of human Indian kala-azar and observing the fate of the parasites when taken up by the dog flea, concludes that no development takes place, and that this supports the view that human kala-azar is not of canine origin. The fact that the dog may be infected with *Herpetomonas ctenocephali*, the natural flagellate of the dog flea, suggests further than the so-called canine kala-azar may have nothing to do with the human disease.

W. V. K.

SUMMARY OF A YEAR'S MOSQUITO WORK IN COLOMBO.—(*Ibid.*) S. P. James here describes the methods employed in and the results of experimental antimosquito operations carried out in Colombo, Ceylon, a city of 213,000 population. After a preliminary survey of the kinds, prevalence and distribution of mosquitos there, five areas in various sections of the city were chosen and experimental campaigns initiated to determine to what degree the different species could be reduced by strictly local measures directed against the larvæ, and the cost, staff required and methods to be used in carrying out the measures

in the whole town. The practical difficulties encountered, the methods, often ingeniously devised, of overcoming them, and the means of checking the results are detailed at some length and will prove of great assistance to those undertaking work of the same nature. The efficacy of the traps for catching adults and of the trap-breeding places are especially to be noted. As regards the practical side of the work the author concludes that mosquitos of domestic or strictly urban habits can by local measures be reduced to a negligible number. W. V. K.

FURTHER STUDIES OF THE THOMPSON-McFADDEN PELLAGRA COMMISSION.—(J. F. Siler, P. E. Garrison and W. J. MacNeal *Jour of the Am. Med. Assn.*, Vol. LXIII, No. 13, Sept. 26, 1914.) A summing up of their first report published in the above journal for Jan. 3, 1914, introduces this article, in which the authors conclude that neither maize nor *Simulidæ* is the means of transmission of the disease, accept as more plausible the possibility of diffusion, the contact with excremental matter of pellagrins and the bite of *Stomoxys calcitrans*. More or less striking features have presented themselves during the progress of further investigation. The authors found among the 847 cases accounted for up to the time of writing that the majority of pellagrous subjects occurred among the female sex, especially white, and those being to great extent workers in the cotton mills of Spartanburg county. The foci of prevalence are located in the mill villages. Furthermore, data concerning dietary and classification as to its special features gave no clue, nor did they allow of a definite conclusion being drawn as to the etiology. The prevalence of pellagra in families with preëxisting cases, either among the immediate members or visiting relatives, offers a more stable basis for the theory that intimate contact may be the means of transmission. "Of 819 persons in the first zone, i. e., living in the same house with a preëxisting case of pellagra, 64, or 6.5% acquired pellagra during the two years 1912-13; in the second zone 1.72% acquired the disease, and in the third zone only 0.52%. Lice, fleas and bedbugs, vermin likely to become carriers, have been considered as more probable carriers than flying insects. Experiments with *Stomoxys* on monkeys remained negative. The bad sanitation of the mill villages, with open privies

and poor sewerage, is a striking feature, and the installment of water-flush closets and proper means for disposal were recommended as prophylactic measures. Remarks on treatment and prognosis are reserved for a future paper, but this much is said that with regard to the dietetic and hygienic treatment good results have been obtained with apparently permanent cures, but return to old surroundings has shown a recurrence of the disease.

The summary concludes that foci of Spartanburg county are located in the mill villages, that children under 2 years were least affected, while the most active periods were in females from 20 to 44 years, in old age of both sexes, and during childhood, from 2 to 10 years. Neither occupation nor diet was apparently significant, but close association seemed to be a factor in 80% of the cases. The spread of pellagra seems to be related to bad sanitary surroundings. Experiments with *Stomoxys* and observations as to the distribution of *Simulidæ* gave no clue. Blood studies indicate a constant lymphocytosis. Inheritance is not a factor.

L. C. Scott.

ATTEMPTS TO TRANSMIT PELLAGRA TO MONKEYS.—(Doctors C. H. Lavinder, E. Francis, R. M. Grimm and W. F. Lorenz, *Jour. Am. Med. Assn.*, Vol. LXIII, No. 13, Sept. 26, 1914.) Attempts at inoculation were made with percolates in saline solution of ground-up brain, spinal cord and membrane, tongue, salivary glands, tonsils, oesophagus, lungs, heart, diaphragm, stomach, liver, spleen, kidney, omentum, mesentery, the intestines with fecal contents, and with skin from pellagrin subjects coming to autopsy. Furthermore, blood from seven pellagrins, pericardial fluid, urine, feces and cerebrospinal fluid were injected, either before or after filtration through a Berkefeld filter, both intravenously and in some cases intraspinally and intracerebrally into monkeys. Feeding experiments with spoiled cornmeal, sputum, feces, thoracic and abdominal organs with contents, as well as of brain, cord and the before-mentioned buccal and abdominal organs, were carried out.

Seventy-two rhesus monkeys, two Java monkeys and three female baboons were used, inoculations being often repeated once on the same animal and usually in more than one manner. Together 103 experiments were made with live or dead material

in the form of pellagrous fluids, or suspensions or emulsions of pellagrous material. The animals have been exposed to the direct rays of the sun either in cages or glass-covered houses. In all cases the experiments were carried out with both filtered and non-filtered material.

Results were negative in all but one experiment. The latter, a rhesus monkey, injected intraspinally with spinal fluid, showed swelling of the arms, falling out of hair, superficial ulceration, red and swollen knuckles, casts and crusts on the skin and diarrhea. The injection was made on April 14, symptoms appearing on May 4. By the 9th of the latter month, scales had dropped away and later (date not stated) the monkey is in its usual condition. The authors do not feel justified in drawing any definite conclusions from an experiment, the manifestation of which might well be accidental.

L. C. S.

MALARIAL PERNICIOUS FEVER.—(L. Sexton, *Southern Medical Journal*, October, 1914, Vol. VII, No. 10.) The article treats of the various details of treatment in cases where the hematuria and comatose conditions have established themselves, or are likely to occur. The kidneys are to be kept flushed by hypodermoclysis, proctoclysis and wherever possible by administration of diuretic waters by mouth. Vomiting is combated by mustard rubbing, ice, cocain or warm water, which, being vomited, relieves the stomach of regurgitated bile. Quinin administrations should be given either in capsules, per rectum, subcutaneously or by simply rubbing into the skin as an ointment. Twenty grain doses are advocated. In the algid state conditions are to be relieved by atropin in 1-100 grain doses, together with hot applications and warm coverings. Prophylaxis consists in protecting the body from chills, indigestion and the avoidance of malarial climates. When a chill has once established itself, hot foot packs, enemas and carbonated waters are given. Hematuria cases should be confined to bed with easily digestible diet and given 10-15 grains of quinin every eight hours for two or three days. The heart action should receive attention with enemas, diuretics, strychnin, caffein and camphorated oil. Besides the administration of atropin in the algid state, hot baths followed by hot drinks, enemas, hot brandy, champagne, etc, should be given; also wrapping in blankets.

L. C. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

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MANAGING EDITORS

CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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EDITORIAL

Venereal Diseases a Public Responsibility.— Considerable notice has been given to the establishment of a municipal clinic and hospital for venereal diseases in charge of the local health authorities of the city of Buffalo, New York. This appears to be the first movement of the sort in this country. Other cities have provisions for venereal diseases in their general hospitals, but in most of these venereal diseases are endured and not invited.

Here and there state laws have made syphilis and gonorrhea reportable diseases, largely for statistical purposes. In some states marriage laws have more specifically dealt with the question in the requirement of health certificates before marriage licenses are issued (Wisconsin notably).

At many conventions of medical and scientific groups of men engaged in the study of hygiene and public morality, the evils of venereal diseases and their consequences have been debated.

Alienists have preached the gospel of prevention but hitherto there has been no active response in the way of exact steps towards a real prevention.

The burden upon the public originating from venereal diseases has not been fully measured and certainly it has not been apprehended. The further we go in the study of criminology and in psychiatry, the more convincing is the knowledge that venereal diseases, syphilis particularly, are more responsible than almost any other cause. The marital infections from gonorrhea are certainly culpable for most of the gynecological accidents needing the surgeon's care and to this morbid factor must be attributed a large percentage of the blind population.

The public generally has no sympathy with vice. The evils derived from vice by devotees to vicious practices have, therefore, only the condemnation and even the spirit of chastisement. The care of venereal diseases is, consequently, not popular with the public. That the far-reaching malevolent influences have not been acknowledged is certain, but this does not relieve the public of the responsibility.

It is not extreme to say that no condition of society at present is more menacing than the two greater venereal diseases of syphilis and gonorrhea and no demand is so imminent as that of adequate protection by proper hospital provision.

The example of European cities (notably Leipsic) should be an object lesson. Not only is hospital provision afforded, but internment for venereal diseases is in many places compulsory—if treatment is undertaken.

The present method in this country is baneful, for it makes the victim of a venereal disease secretive and neglectful, by surrounding treatment at a public institution with such an atmosphere of incrimination that only when forced the patient applies for relief.

The medical side of the question should be segregated from the moral and the social and venereal diseases should have the place in the hospital plan which their importance demands.

Isadore Dyer.

Food and Drug Laws: Uniformity.—On October 8 last the Chamber of Congress of the United States met at Washington to deliberate the question of uniformity in food and drug control in the several states. Subcommittees were appointed to study the detail of the subject for future report.

Of more importance was the passage of a resolution endorsing the bureau in the Department of Agriculture and its function of coördinating state enforcement of pure food and pure drug laws.

In declaring its position the Committee of the Chamber of Commerce lays down the proposal to study the wholesaler, retailer, consumer, manufacturer; the official and all others concerned in the production, handling and consumption of food and drugs.

A concrete statement emanated from the general committee of the Chamber of Commerce on uniformity as representing "the highest degree of efficiency in food and drug control which it is possible to have prevail universally and equally in every part of the nation."

The Chamber of Commerce of the United States is constituted from some 600 local boards of trade, and other associations with similar function. In its composition all classes of tradesmen and manufacturers are represented. We are profoundly interested in the activity inspired by this body and more so because the preliminary platform of organization for work would show utilitarianism of the first order and such a propensity among those who profit at the expense of the public, as a rule, is a signal of a change in the times. It requires only the men-

tion of that heterogenous body styled "The National League of Medical Freedom" to indicate our meaning. On the one hand, a body of representative merchants, studying the measures to further scientific preventive medicine and to support the constituted authorities; on the other hand a body with the declared purpose of protecting the interests of its constituency, made of fraudulent pretense in drug compounds, malcontents and anarchistic free lances.

The education of the public is a slow process, but with the real business interests coöperating with the scientific and constituted authorities, it would seem as if the end would be in sight.

Isadore Dyer.

ORIGINAL ARTICLES

NOTES UPON HUMAN FILARIASIS (*FILARIA LOA* *GUYOT* AND *FILARIA BANCROFTI* COBBOLD).

By

ALLEN J. SMITH, M. D.,

and

DAMASO RIVAS, M. D.,

of Philadelphia.

(From Laboratory of Comparative Pathology and Tropical Medicine, School of Medicine, University of Pennsylvania.)

Within the past four years two cases of infestation by *filaria loa* Guyot and three by *filaria bancrofti* Cobbold have been encountered in the work of this laboratory, affording opportunity for a number of observations which are believed to be of sufficient interest to warrant publication.

Cases of *Filaria loa*.

Specimens from the two *loa* cases were presented by the writers in association with Drs. James A. Babbitt and W. F. Moore, of this city, before the Philadelphia Pathological Society in 1911 (Proc. Phila. Path. Soc., February, 1911; n. s., Vol. 14, No. 1, p. 2), one of the cases, Mrs. J., having been previously studied by these gentlemen and subsequently referred to the writers by them.

The first of the *loa* cases, Mr. K., a native white Philadelphian, was always well and lived in hygienic surroundings save during a period of seven years, from 1892 to 1899, when he served as a missionary in the Kameroun District of the West African Coast, during which period he had several severe attacks of malarial fever. He did not know that he was infested by filariae at the time, although the district in which he resided in Africa was one in which this parasite frequently is met. In 1905, six years after returning to his home in this city, he was one day attracted by a feeling of discomfort in his right eye and on examining it with a mirror distinctly saw a *filaria* move beneath the conjunctiva

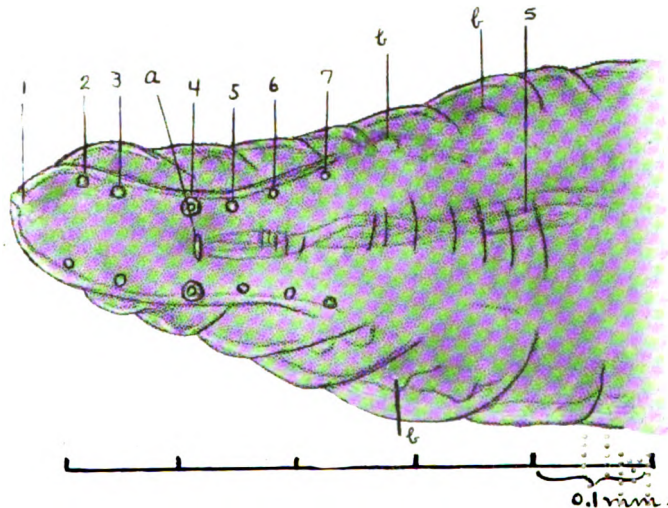
across the bulb of the eye below the cornea, the transit across the eyeball occupying from three to five minutes. The natural presumption, based mainly upon the prevalence of *filaria loa* in the Kameroun, is that the parasitism was acquired in Africa; a view which is confirmed by the subject's recollection that during his African life various areas of cutaneous tenderness and swelling appeared at intervals, and that since his return to America, at long intervals, cutaneous disturbances of the same type have transiently occurred. During the spring of 1910 Mr. K. felt vague tingling sensations in the skin of the left side of his face as though from a beginning neuralgia, the area affected being sensitive to pressure and becoming somewhat irritated if rubbed. Late in the afternoon of April 24, 1910, the sensation moved rather rapidly from the left side of the face below the eye upward over the bridge of the nose (accompanied here, where the bone is close to the surface, by a slight but distinct elongate swelling) to a position just over the right eye, below the brow; and light pressure permitted him to recognize a faint vermicular movement. With full recognition of the significance of these phenomena and realizing the superficial location of the parasite, Mr. K. went with all haste to the nearest physician, Dr. G. C. Jenkins, of Germantown, Philadelphia, and induced him to cut down upon and extract the worm. This was done; but unfortunately in extraction the specimen was broken, the anterior third, probably, being lost from the specimen as now preserved. It is stated that it was nearly if not quite an inch and a half in length before being placed in alcohol and that it became markedly shrunken thereafter. In August, 1910, Mr. K. presented the specimen to the writers. He had never had an examination of his blood for the presence of microfilariae, but at this time and several times thereafter his blood was examined by us with negative results; so that the inference is fair that, whatever number of filariae he may originally have harbored, at the time of examination there were no producing females and that probably the specimen removed, a male, had been solitary. The following description of the imperfect specimen was made at the time in the laboratory records:

"From the torn anterior level of the body to the tip of the tail the fragment of worm measured 24 mm., with a mass of internal tubes protruding about 5 mm. further anteriorly, from which a single distorted genital tube continued perhaps a centimeter and a half more. At thickest level (near anterior end of fragment) the vertical diameter was 0.7 mm., the transverse diameter a little less, the lateral flattening becoming more pronounced as the posterior extremity was approached. The cuticle showed at irregular positions the small tubercles described for *filaria loa* (characteristic for the proposed genus *Loa*); but instead of being otherwise smooth, was found thrown into coarse circular folds (perhaps due to shrinkage after the rupture) and showing a fine circular striation (about 0.004 mm. apart). The tail was not terminated by the comparatively blunt, rounded end described for *filaria loa* and was not as much incurved. It possessed a more conical end, with rounded tip, with the central surface flattened into an inconspicuous bursa, the cuticle thickening as a ridge along the margins of the latter. Cloaca a little over 0.2 mm. from the tip of tail. Spicules very uncertain, but apparently as in drawing (Fig. 1) equal and slightly over 0.5 mm. in length (did not stand out in sharp contrast with body structure as chitinous material, and not as coarse as depicted by Loos for *filaria loa*). The papillæ did not agree with those described for *filaria loa*. The writers recognized a minute papilla, unpaired, at tip of tail; two pairs of post-anal papillæ, both small; four pairs of pre-anal papillæ, No. 4 the largest, of fungiform shape, Nos. 5, 6 and 7 progressively smaller and conical (none as large as those described for *filaria loa*)."

These characters, which seem to the writers to be of important variation from those established for the known species, are presented with the purpose of suggesting the existence of another species of the proposed genus *Loa* than that now known as *filaria loa*, or *Loa loa*. There can be little doubt from the general circumstances of its mode of parasitism, its probable acquirement in a district where these filariæ are known to prevail, its general morphological characters and the tuberculation of its cuticle, that it is of the same genus as hitherto described specimens; but specifically there may well be differences such as are above outlined, some of which cannot have been due to the damaged condition of the specimen (striation of cuticle, shape of tail, bursal flattening, and the caudal papillæ). The coarse circular folds of the cuticle may be due to artefact and the uncertainty as to the spicules may also possibly have been due

to obscuration from internal displacement when the worm was torn.

The second case of *loa* filariasis occurred in E. T. J., a white woman, a native of Washington, Pennsylvania, a trained nurse, the wife of an American medical missionary in the Kameroun District of West Africa. She went in full health, shortly after her marriage, to Africa in 1897, remaining for twelve years; after which, in 1909, she was invalided home. She stated that during her residence in Africa she had reason to believe that for longer or shorter periods she had repeatedly been the host of different parasites, including intestinal entozoa, malarial hæmatozoa, as well as chigoes and other dermal parasites; and had to her certain knowledge harbored *filaria loa* for some years. The microfilariae of the last were recognized in her blood while in Africa, although at the time supposed to be *microfilaria bancrofti*; and an adult *loa* had been extracted by her husband from the subcutaneous tissue of her upper anterior left chest wall. While without organic disease she had lost her originally bright complexion, had been reduced in weight and strength, had acquired choreiform movement of the head and complained of a marked loss of memory and a feeling of mental fatigue. She had frequently before and since her return to America noted the localized cutaneous swellings and irritation commonly met in infestation by *loa*; and believed, because of their frequent and close occurrence in different parts of the body, that she continued to harbor a number of the worms. Mrs. J. was referred to the writers with the purpose of determining the question of whether, as had been suspected, she had a dual infestation by *filaria loa* and *filaria bancrofti*, or whether the infestation was of the former parasite alone. Examination of her blood at time of our first observation showed a moderate anaemia, with an eosinophilia of 7.06 per cent. The red cells were reduced to 3,000,000; the white cells number 8,000 per cubic millimeter; hemoglobin stood at 72 per cent. Subsequent examinations extending over several months gave comparable figures. About midday numerous microfilariae were found present in the peripheral blood; toward midnight, while not absolutely absent, very few were found. (On the day of first examination two were



ILLUSTRATING PAPER OF DRS. SMITH AND RIVAS

Fig. 1—Tail of Male *Filaria loa* from Case 1; ventral aspect. 1, unpaired conical terminal papilla; 2, 3, conical postanal paired papillae; 4, paired fungiform papillae; 5, 6, 7, paired conical preanal papillae; a—cloaca; b—tubercles; s—spicules. The border of the bursa follows the double-contoured line along the sites of the postanal and preanal papillae.

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found in fifty cover-glass preparations made about 11 p. m.) In corroboration of this and similar findings during the early part of the study, on February 1, 1911, examination of a twenty-four hour cycle, with measured equal drops of blood, showed the following distribution of microfilariæ for the peripheral blood:

Hour of Collection.	No. of Microfilariæ Found.	Percentage of Total.
2 A. M.....	9	0.578+
4 A. M.....	11	0.7—
6 A. M.....	41	2.59+
8 A. M.....	168	10.67+
10 A. M.....	298	18.93+
12 M.....	531	33.73+
2 P. M.....	252	16.01+
4 P. M.....	146	8.88+
6 P. M.....	91	5.78+
8 P. M.....	23	1.46+
10 P. M.....	5	0.318—
12 P. M.....	5	0.318—
	1,580	100.—

The filarial embryos, in detailed study, whether obtained at night or in the daytime, were uniform in appearance. They measured as an average, with but little variation, 280 micromillimeters in length, and at the thickest level (in the second fourth from the head end) 7 to 7.5 micromillimeters in diameter. In ordinary preparations they were found ensheathed in the usual embryonic sac (the ovular membrane), which at times extended 40 or 50 micromillimeters beyond one or other end of the worm. Each tapered very gradually and slightly toward the head end, which rounded rather bluntly from a base of about 4 micromillimeters in diameter; and from the thickest level there was a gradual and uniform tapering to the tail, which ended in a long, slender tip. The cuticle was smooth (with fine annular striations showing with side-light in the concave side of curves). In living but nearly quiet examples it could be seen that there were several papillated lips and a protrusile spicule in the mouth. Apparently at the time of their existence in the blood of the host these embryos possess a small buccal

cavity, the base or pharyngeal part of which is protrusile, bearing the spicule forward, and on retraction withdrawing it into the cavity. This buccal base is projected between and beyond the border of the lips as a rounded eminence, thus carrying forward the spicule as a penetrating armature. When the buccal base is thus protruded the border of the lips appears as a slightly undulating collar about it (like a retracted prepuce in relation to an exposed glans penis, whence the name "preputial collar" applied by Manson and others). An oesophagus and alimentary canal could be indistinctly made out. In stained examples the nuclear granules were distinctly larger but not so well defined as those of *microfilaria bancrofti*; Manson's "V" spot showed near the posterior end of the first third; the tail spot at 30 to 40 micromillimeters from the tip of the tail. The tendency pointed out by Manson for *microfilaria loa* to be more sinuously and pliantly curved, and to more frequently show sharp recurvation of the tail and more curving near the head than is true of *microfilaria bancrofti*, was well borne out in the fixed and stained specimens.

No opportunity to study an adult parasite from this case was possible; but based upon the above observations a positive diagnosis of infestation by *filaria loa* alone was made.

Filaria Bancrofti.

In 1911 two Porto Rican students of the University of Pennsylvania, brothers, one known to harbor *filaria bancrofti* and to have suffered several acute attacks of lymphangitis of the right thigh, the other found by us to be the host of the same parasite, were studied; and in 1912 a third Porto Rican, at the time a hospital interne in this city, was found infested by *filaria bancrofti*. The first and second of these gentlemen kindly lent themselves to extended observation; which was impossible for the third because of professional engagements. The first of the brothers, J. J. A., aet. 20 years, presented a slight degree of anæmia, the hemoglobin being 80 per cent, red cells numbering 4,800,000; white corpuscles 6,000. The differential count of leucocytes showed an eosinophilia of 19 per cent, with a reduction of the polynuclear neutrophiles to 42.5 per cent. In or-

dinary fresh blood examination no filarial embryos were found during the day and early night, but during the period from midnight to daybreak they were usually quite numerous in the preparations (see twenty-four hour cycles below).

The second case, A. A., aet. 19, presented no symptoms or lesions referable to filariasis; but inasmuch as he had been in the habit of sleeping in the same room with his brother, it was thought possible that he might have become infested, particularly as his blood (taken originally about noon on August 30, 1911) showed a moderate eosinophilia, of 8.7 per cent, although otherwise showing no important abnormalities. This eosinophilia, it is true, might have been disregarded and equally held as perhaps due to some other cause; but on examining the sediment from a comparatively large amount of blood (0.1 c. c. by the acetic acid and sedimentation method, below) several embryo filariæ were met in the daytime peripheral blood.

The third case, Dr. S., was examined for filariasis because of a transient hematuria of cystic origin supposed originally to be due to local papillomatous formation at the base of the bladder. Cystoscopic examination showed a finely granulated appearance of the cystic mucous membrane at the base; and one of the tiny elevations which was scraped off was found to be made up entirely of the vesical epithelium. The symptom ceased spontaneously; and in the interval of several years no further evidence of bladder disturbance is known. Examination of the blood showed also in this case a moderate eosinophilia, and the night blood was found to contain a few microfilariæ.

In all three of these cases of infestation by *filaria bancrofti* comparison of the microfilariæ with those of the case of *loa* infestation (above) confirmed fully the differences in the embryos which have been made by other writers, the more rigid curves of the *microfilaria bancrofti*, the less marked tendency to sharp recurvation of tail and head ends, the smaller and more sharply defined chromatic granules, and the position of the developmental "spots" mentioned by Manson.

Technical.

1. *Concentration of Microfilariae in Small Areas in Blood Spreads*—In making spreads of comparatively large amounts of blood to give greater certainty of discovery of microfilariae, it was found possible to secure a concentration of the parasites in small areas and thus facilitate their quick recognition by the following simple method of procedure. Two large drops of blood from the puncture in the finger or ear lobe are mixed, as drawn on the slide, with one drop of a one per cent. solution of sodium citrate (sufficient to slow coagulation but not to prevent it). The mixture is then drawn out in a thick film over a restricted part of the slide, and the preparation placed in a covered Petri dish with a moist filter paper on the bottom; and the whole put into the incubator at body temperature for half an hour. During this period the blood of the film slowly clots and in the shrinkage of the clot a number of open areas containing only the citrated serum result. Into these the microfilariae make their way with more or less certainty, so that in some instances a dozen or more may be included in the field of a 16 mm. lens. The film, for permanent preparation, is thereafter fixed by heat: the corpuscles in the clotted film laked in water containing 2 per cent of acetic acid; and after washing in tap water the film is stained with hematoxylin and eosin or other agents, as desired.

2. *Acetic Acid Concentration Method of Examining the Blood for Microfilariae*.—When there are but few microfilariae in the peripheral blood, as in the period of absence of either the diurnal or the nocturnal species, or when there are, even at optimum periods, very few, and where therefore there is danger of failure to recognize the infestation, the following procedure has been found of value. (See also presentation of this method before Philadelphia Pathological Society, *Proc. Phila. Patho. Soc.*, July, 1911, n. s. Vol. 14, No. 4, p. 127.) From 0.1 c. c. of blood to 1.0 c. c. of blood is taken from the finger and collected in 5 c. c. of a 2 per cent. acetic acid solution for the purpose of laking the blood. The mixture is shaken gently for several minutes and then centrifuged, and spreads are made

from the sediment. By this method it was found possible to recognize microfilariae in the peripheral blood regardless of the hour when the specimen of blood was collected. Of course the greater number of embryos were met at night in the case of *filaria bancrofti* and in day in case of *filaria loa*, but in no single instance where this method of procedure was followed, regardless of the hour, did the writers fail to find them. In the second case of *filaria bancrofti* in which six daily examinations between 11 a. m. and 7 p. m. failed to show the microfilariae, positive results followed for the same period when this concentration method was employed (in proportion of about 20 embryos for 1 c. c. of blood collected). The advantage of the method may be illustrated by a statement of the results of examination of a 24-hour cycle of the first and second cases of *filaria bancrofti*:

FIRST CASE OF *FILARIA BANCROFTI*, J. J. A.; TWENTY-FOUR
HOUR CYCLE.

Hour of Collection	Fresh Blood Films Total in 2 Equal Films		Dried and Stained Thick Films. Total in 2 Equal Films		Acetic Acid Concen- tration Method	
	No. of Micro- filariae found	Percentage of total	No. of Micro- filariae found	Percentage of total	No. of Micro- filariae found in 1 c.c. blood	Percentage of total
12 M.	0	0	3	0.6+	30	0.2+
2 P. M.	0	0	0	0	20	0.16+
4 P. M.	0	0	0	0	10	0.08+
6 P. M.	0	0	3	0.6+	40	0.32+
8 P. M.	0	0	8	1.7—	60	0.49+
10 P. M.	4	1.7+	28	5.9+	600	4.95+
12 P. M.	28	12.5+	76	16.1+	750	6.18+
2 A. M.	56	25.1+	116	24.5+	3500	28.87+
4 A. M.	70	31.2+	110	23.1—	3200	26.4+
6 A. M.	36	16.1+	76	15.2+	2800	23.1+
8 A. M.	24	10.7+	42	9.7+	900	7.4+
10 A. M.	5	2.8+	10	2.1+	210	1.7+
	223	100.—	472	100.—	12120	100.—

SECOND CASE OF *FILARIA BANCROFTI*, A. A.; TWENTY-FOUR
HOUR CYCLE.

Hour of Collection	Fresh Blood Films Total in 2 Equal Films		Dried and Stained Thick Films. Total in 2 Equal Films		Acetic Acid Concen- tration Method	
	No. of Micro- filariae found	Percentage of total	No. of Micro- filariae found	Percentage of total	No. of Micro- filariae found in 1 c.c. blood	Percentage of total
12 M.	0	0	5	0.78+	50	0.265+
2 P. M.	0	0	1	0.15+	40	0.212+
4 P. M.	0	0	0	0.	30	0.159+
6 P. M.	0	0	1	0.15+	40	0.212+
8 P. M.	0	0	6	0.94+	100	0.531+
10 P. M.	5	1.4+	36	5.67+	800	4.248+
12 P. M.	52	14.7+	90	14.17+	2600	13.800+
2 A. M.	98	27.8—	140	22.00+	6500	34.510+
4 A. M.	114	32.3—	155	24.20+	5200	27.610+
6 A. M.	52	14.7+	115	18.11+	2000	10.630+
8 A. M.	24	7.1—	64	10.00+	1100	5.84+
10 A. M.	8	2.3—	8	3.14+	350	1.86—
	353	100.—	635	100.—	188810	100.—

The films were in each case made with equal amounts from marked pipettes.

Periodicity of the *Microfilariae* in the Peripheral Blood.

The above tables of counts at intervals through the twenty-four-hour cycle illustrate the well-known periodic prevalence of the *microfilaria loa* in the peripheral blood in the day and of the *microfilaria bancrofti* at night; and other similar cyclic and isolated counts in these cases were in full harmony. However, it is clear that this periodicity does not consist of an alternation of periods of absolute absence and periods of presence of the embryo in this part of the circulation; but that there are a certain number present in the periphery all the time throughout the full twenty-four hours, easily demonstrable by the concentration of comparatively large amounts of the blood. From these cyclic studies, too, it would appear that for each of these two species the optimum period for finding the embryos in the peripheral area is roughly about one-third of the daily cycle (about 8 a. m. to 4 p. m. for *filaria loa*, and about midnight to 8 a. m. for *filaria bancrofti*).

For the explanation of this periodicity and the contrast of periods in the two species numerous explanations have been offered by different writers, none of which are entirely satisfying, although several unquestionably have more than mere theoretical basis; and with the interested coöperation of the subjects, Mrs. J., Messrs. J. A. A. and A. A., the writers took up a number of observations in the hope of contributing toward the clarification of the difficulties.

Among these theories, that of Myers (which would have the nocturnal access of *microfilaria bancrofti* depend upon their birth each night, and their disappearance during the day depend upon the death of the brood) can, it seems to us, be readily disposed of. Calculating from the numbers found in 1 c. c. of blood in the subjects of *filaria bancrofti* above given, the writers hold that with only an approximately even distribution of the embryos in the blood, there would be required broods of 5,000,000 to 7,000,000 each night; which would seem preposterous when the long period of years in which the possibility of their discovery in the blood of a given host each and every night is recalled. That any reasonable number of females within known degrees of infestation of a single individual should be able to exhibit such fecundity is not to be thought of. Moreover, if not all of a given brood die the day after the night of their birth, the total number should be cumulative and the periodicity lost, which is not known. From actual observation of these cases the writers can affirm that the length of life of the individual *microfilaria* exceeds considerably a twenty-four-hour cycle. A living motile example of *microfilaria loa* from Mrs. J. was observed to continue its active movements under the unsealed cover on a glass slide under the microscope for over thirty-nine hours. Of 249 *microfilaria bancrofti* collected at time of a second cyclic examination of the blood of J. A. A., 200 were active after twenty-four hours; 162 after two days; 95 after three days; 73 after four days; 36 after five days; 17 after six days; 5 after seven days; and 1 after eight days; the preparations being sealed fresh films on the glass slide at room temperature. Another experiment made, in which the preparations were not sealed, but kept in moist chambers at room temperature,

gave practically the same results; while controls similarly prepared, but kept at 37° C., died out entirely in between two and three days earlier. Such results, to say nothing of other arguments which are adduced by various writers, militate too strongly, in the opinion of the writers, with this theory to permit any credence thereof.

Before Manson's recognition of the diurnal type of microfilariæ, of practically the same body measurements as the previously known nocturnal microfilariæ, mechanical theories were widely credited, particularly that of von Linstow. According to this view, the embryos of *filaria bancrofti* fail to appear in the blood of the cutaneous capillaries in daytime because then the caliber of these tubes is diminished by muscular contraction and tonicity; that at nighttime, during the relaxation of sleep and corresponding with the cutaneous flush of sleep, the capillaries of the surface widen out and at this time the embryo filariæ are carried by the current through the superficial areas. (This idea of course holds the embryo within its sac as practically passive and dependent entirely upon the blood current for its convection.) As soon as the specific character of the *microfilaria loa* or *diurna* was realized, this theory of course lost its vogue. But that mechanical influences of one or other kind are in some subordinate degree operative is to be surely recognized by some of the observations made in the course of our studies. The above cyclical enumerations indicate that there are always a certain number of the microfilariæ in the cutaneous capillaries. Stimulation of the cardiac activity by a half ounce dose of brandy at one time, and by half hour's general exercise at another, in the case of Mrs. J. (infested by *filaria loa*) produced slight increase in the number of microfilariæ found in comparison of equal films prepared before and after such medication and exercise near midday. In the same case, too, on one occasion at midday the left hand was held for fifteen minutes in water at 50° F., while for the same period the right hand was kept in water at 110° F. Equal films showed a slight increase of the microfilariæ for the warm hand (208:233), presumably because of the relaxing influence of the warmth upon the surface capillaries rather than from thermotaxis. Further, in case of

A. A. (infected by *filaria bancrofti*), partly with this point in view and partly to determine the advantageous source of collection of blood for diagnosis, proportionate amounts of blood were taken simultaneously from the tip of the little finger and by syringe from one of the veins of the forearm. In each sample the blood was mixed with acetic acid solution, centrifuged and the sediment examined with the result that 360 embryos were found per cubic centimeter of capillary blood, and 160 per cubic centimeter of the venous blood. A second and third experiment showed a slight but distinct excess in the capillary blood. In other words, these observations would lead us to believe that the number of filarial embryos swept by the arterial blood into the capillaries of the surface is in some degree influenced by the force of the arterial flow, being increased by factors which increase the cardiac propulsive efficiency; that these embryos are probably held to some degree in the narrow and intricate capillary tubes and therefore are apt to be proportionately more numerous in the cutaneous capillaries than in the corresponding veins; and that, too, the effect of factors making for the contraction or compression of the capillaries on the one hand, and for their relaxation or widening on the other, may in some measure account for the number obtained from the skin surface under different conditions of the skin. However, it must at once be acknowledged that whatever force these observations may have, they alone are inadequate to explain the true periodicity, i. e., the great numbers at certain periods and the relative absence at others.

As an inquiry into the possibility of a phototropic influence being involved an experiment was arranged as follows in case of Mrs. J. (*lou* case). On April 15, 1911, she wore a long and heavy glove on the left hand from midnight to midday, the right hand being left uncovered and therefore exposed to daylight from dawn until noon. Toward the close of this period, during which she remained in a room of practically constant temperature, she held the right hand close to the window for special exposure to light. Films of equal amounts of blood from the left and from the right hand were prepared at noon. Curiously the film from the covered hand showed 79 micro-

filariæ; that from the exposed hand, 41. Equal films made at the same time from a toe which had been continuously covered from light and from the lobe of an ear showed in each 60 embryos. The difference in numbers of these diurnal microfilariæ in the two hands can scarcely therefore have been due to any influence of light, and was thought to be due to a mechanical pressure of the glove, restricting the flow and therefore causing greater accumulation of the embryos in the covered member.

After Manson had published his account of finding the microfilariæ of a subject of *filaria bancrofti*, who had committed suicide at 8:30 in the morning, predominantly collected in the pulmonary circulation, in the blood of the left heart and the aorta, the older mechanical theories in explanation of the periodicity gave way to a chemotropic theory advanced by Manson and associated with the older relation of the period of prevalence in the cutaneous capillaries with sleep, as pointed out by Mackenzie. Nevertheless when one notes the marked variation for different filarial species in the time of cutaneous periodicity of the embryos, and particularly when one remembers that the periodic microfilariæ, because of their ensheathment, are practically passive bodies in the blood stream and unable in any important degree to move of their own power to different parts of the body in response to positive or negative chemotropic influences, this view becomes, to say the least, a questionable one. (It should be recalled, too, that microfilariæ which do not possess a sheath and are therefore fully motile, show no periodicity, and that the only non-periodic form with a sheath, *microfilaria philippinensis*, has its sheath so closely applied to the worm that it does not seriously impede its movements.) The writers believe that eventually the explanation for this peculiarity will be found to rest in some form of mechanical operation. That there are mechanical factors operative to a secondary degree we believe is proved by the points shown above, in the greater number of embryos found in the skin capillaries than in the veins, the increase noted in connection with warming the surface, and in the effects of cardiac stimulation by alcohol and exercise in the *loa* subject. Differing from von Linstow, we would be inclined to think that *the period of their special discovery in the skin*

corresponds not with a period of relaxation of the capillaries, but rather with a period of contraction (and therefore of retention in this district). This idea at least would be in consonance with the fact that the smaller and the actively motile unsheathed microfilariæ show no periodicity (that is, they are able to make their way with readiness through the capillary barriers both of the lungs and of the periphery). In application of this idea, if the three periods of the day above referred to (midnight to 8 a. m., period of cutaneous prevalence of *filaria bancrofti*; 8 a. m. to 4 p. m., period of cutaneous prevalence of *filaria loa*; 4 p. m. to midnight, period of paucity of both in skin) be regarded respectively as the periods of (a) greatest peripheral relaxation from fatigue and sound sleep, (b) of recovery from fatigue and the resumption of capillary tone in the periphery, and (c) as a period of capillary constriction from the combined influences of tone and of compression from muscular activity; and if further it be believed that, while both the diurnal and nocturnal forms of filarial embryos are restricted (but not prevented) in their motility by their ensheathment, the *microfilaria loa* evinces greater motile effort in its characteristic curling of the ends and body; then the following mechanism might be imagined to explain the periodicities of the two forms. In a case of nocturnal filariasis the parasites passing from the lungs find no difficulty in being passively conveyed through the peripheral capillaries (a) during the evening and early night (*period of relaxation*): they are caught by the (b) first *resumption of capillary tone* and appear therefore from midnight on in the periphery, but by their efforts manage to pass through the capillaries in this period of mere tonicity, and are quickly swept on by the venous current to the lungs, where they are again interfered with for a time, thereafter repeating the cycle. Should their cycle be not completed by the time (c) of the period of waking effort (*capillary tone with added compression of capillaries by muscular effort*) they are prevented from entering the peripheral capillaries because of the reduced caliber of the latter, and cannot do so until the next period of body relaxation appears (i. e., until nearly night). On the contrary, in case of the more effective motility of the *loa* embryo,

their paucity in the peripheral blood (a) in the period of relaxation (4 p. m. to midnight) is for the same reason as offered for the *microfilaria bancrofti*; their small numbers (b) during the period of simple tonicity of the capillaries (midnight to 8 a. m.) is to be interpreted because, although meeting the same moderate opposition, their greater motile effectiveness enables them to pass; but (c) when the capillaries are markedly diminished from a combination of tonic contraction and of muscular compression (8 a. m. to 4 p. m.), they are no longer able to progress easily and therefore become demonstrable.

Unfortunately, since the formulation of these tentative ideas the writers have not had opportunity to attempt their verification; and for the present their only value is that they seem consistent with the known facts and are particularly constant with the cycles as above observed in our own cases. They are, however, susceptible of proof or of refutation, and their publication may lead to further study on the part of observers in position to add to our present knowledge.

Experiments with Bedbugs (*cimex lectularius*).

In conclusion, a few observations should be added bearing upon the matter of *cimex lectularius* as a possible intermediate host of filariæ and the matter of including study of these animals in diagnostic investigations involving households.

In July, 1911, a number of bedbugs were fed upon the two Porto Rican students infested with *filaria bancrofti*. Examination of the stomach of one of the bugs immediately after feeding revealed a great number of filarial embryos in the stomach of the bug, some of which had already emerged from the sheath. In one of the bugs, a small, pale and relatively transparent one, the microfilaria could be observed within the body of the living animal (held on the slide by placing it on its back in a small drop of water). On the second day in this particular bedbug free and actively moving microfilaria could be seen all through the body, in the limbs and in the antennæ; and after the third and eighth day living microfilaria continued, for the most part moving, but in several instances apparently lodged in the tissues of the prothorax and at the base of the proboscis; but no growth

or change of morphology was appreciated. After the eighth day the infested animals were killed and sectioned; but no development of the microfilariae was recognized. It is questionable whether larval development is possible in the bedbug; but the chance of finding filarial embryos in bedbugs in houses where subjects of filariasis have passed the night is at least of interest and may perhaps occasionally be of practical importance.

OBSERVATIONS IN TROPICAL PATHOLOGY. I.*
A Brief Analysis of Thirty-seven Fatal Cases in Which Pellagra
Has Been Pointed Out Alone or in Association
with Other Diseases.

By

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(From the Board of Health Laboratories.)

The well-directed scientific investigation of this disease on such a scale as that now employed by the Thompson-McFadden Pellagra Commission shows how thoroughly American interest in this disease has been awakened. Since the beginning of the work done by the Illinois Pellagra Commission, the local interest in the disease on the Isthmus has grown, and a visit from Dr. L. W. Sambon and Capt. J. F. Siler, M. C., U. S. A., has offered further stimulation to more careful observation.

Dr. Sambon strongly believes in a protozoan theory in its etiology and believes that it is an insect-borne disease. Capt. Siler feels convinced that it is an infectious disease and that some element associated with close confinement in domestic life will be discovered which will explain its transmission.

Such theories, of course, lend interest to Canal Zone work where much attention is given to fighting insect carriers of disease. It raises the questions on the Zone as to whether the disease is indigenous, its rate of incidence and the probable effect of sanitation on any natural conditions which might seem to favor the dissemination of such a disease.

The desire of investigators to know what our records contain has led Dr. Samuel T. Darling, Chief of the Board of Health Laboratory at Ancon, to direct me in assembling and organizing what data we possess. The analysis of the series will be done as briefly as possible and with a full realization of the difficul-

*Permission for publication has been granted by Colonel Charles F. Mason, Medical Corps, U. S. Army, Chief Health Officer, Panama Canal.

ties which confront one in establishing the diagnosis of pellagra. The pattern chosen for the selection of those cases thought to represent the disease will be drawn from the definition given by Castellani and Chalmers. They state that "Pellagra is a chronic disease of unknown causation, characterized by gastro-intestinal, cutaneous, and nervous symptoms, sometimes ending in insanity."

Could anything offer a more indefinite set of clinical manifestations to the diagnostician in the Tropics? A disease without a specific means for its identification and with a tripod of symptoms and signs that are commonly observed alone or together in other conditions. The question necessarily resolves itself into a diagnosis arrived at by exclusion. Such a state of affairs is a boon to those inclined to seek the line of least resistance in diagnosis and is distressing to those who faithfully seek the typical syndrome.

When attention is called to the black laborers who comprise the greater part of the Canal Zone population, their mental status, the incidence of dhobie itch, various forms of diarrhea, the lack of care given the teeth, and the prevalence of genital diseases, it is not surprising that once pellagra is pointed out as a disease, that many individuals should at once appear who seem on a cursory examination to present part or all of the syndrome assigned to the disease. It is common in the terminal stages of most diseases to find a foul stomatitis if the individual has extensive dental decay and has given his mouth no care. Genital and intestinal inflammations and insanity have many common causes. The daily life of these laborers and domestic servants exposes them to factors which make even the significant dermatitis a lesion for differential study.

To offer then, an unassailable diagnosis of pellagra, the full picture and history should be present and it should not be possible to explain the presence of any of the legs of the tripod of manifestations by the presence of any common etiological factor. Under such conditions differences of opinion are sure to exist and this analysis is approached with many misgivings.

There are thirty-seven cases indicated in 4,020 anatomical records at Ancon. Prior to December 8, 1909, only two cases

had been reported in the anatomical records or the Proceedings of the Medical Association of the Isthmian Canal Zone. Since then, in approximately the same interval of time, thirty-five cases have been added to the anatomical records alone.

A study of the anatomical records in association with the history and clinical findings recorded against these individuals would indicate that many are listed as pellagrins who did not present sufficient factors to warrant that diagnosis, and a review of the discussion which followed the report of the first case recognized on the Canal Zone suggests that a few typical cases had occurred which were not recognized as pellagra, since five of the members of the association were each able to cite one case that was probably a pellagrin.

The analysis will be conducted along the lines laid down by the Thompson-McFadden Pellagra Commission in so far as Ancon records can be fitted into so comprehensive a scheme.

The following tables include the entire 37 cases, whether at the time of autopsy they seemed to fill all the requirements or not for the disease. After the individual case analysis, a brief review of the same points will be offered in regard to the accepted and doubtful cases.

Nativity.

Jamaican (negro).....	13
Barbados (negro).....	7
Martinique (negro).....	4
St. Lucia (negro).....	3
Montserrat (negro).....	2
Guadeloupe (negro).....	2
Panama (mestizo).....	2
Nevis (negro).....	1
Antigua (negro).....	1
Panama (negro) (parents Jamaican).....	1
Unknown West Indian negro.....	1
Total.....	37

Length of Residence on the Isthmus.

3 months or less.....	2
6 months to 12 months.....	4
1 year to 2 years.....	3

2 years to 3 years.....	4
3 years to 6 years.....	8
10 years to 20 years.....	4
6 years to 10 years.....	0
20 years to 30 years.....	3
Life time.....	3
Unknown	6
Total.....	37

Local Residence on Canal Zone.

Colon	5
Camp Biedl.....	1— 6
Rio Grande.....	1
Culebra	3
Empire	4
Golden Green.....	2
Cow Pens.....	1
Pedro Miguel.....	3—14
Panama	6
Guachapali	3
San Miguel.....	1—10
Gorgona	2
Tabernilla	1
Palmetto	1
New Gatun.....	3— 7
Total.....	37

Ages.

Up to 20 years.....	0
20 years to 29 years.....	6
30 years to 39 years.....	18
40 years to 49 years.....	10
50 years to 59 years.....	1
60 years to 69 years.....	0
70 years to 79 years.....	2
Total.....	37

Sex.

Males	12
Females	25
Total.....	37

Occupation.

Housework	25
Laborers	7
Tailor	1
Baker	1
Policeman	1
Barber	1
Corral Helper.....	1
<hr/>	
Total.....	37

Seasonal Incidence.

This has been determined by subtracting the stated duration of the attack from the time of admission to the hospital. Where no history was obtained the month of admission to hospital was used.

January	1
February	0
March	1
April	3
May	2
June	2
July	7
August	3
September	7
October	3
November	4
December	4
<hr/>	
Total.....	37

Diet.

The diet is largely that of vegetables, fruit and fish. Other meats are at times used but in a general way meat is not an important part of their diet. It may be said that they lead chiefly a vegetarian existence.

Analysis of Individual Cases.**Case I. History No. 508-A. Autopsy No. 1,821.**

This case was the first one to be reported from this region, and was presented by Dr. Darling to the Medical Society November 10, 1909. He saw the case at autopsy, which was being held by Dr. McCarthy.

"The body was that of a Jamaican negress from Rio Grande who had lived on the Isthmus 20 years. She was 30 years of age and had been confined in the Asylum for about four weeks previous to her death. There was no information regarding the onset nor the duration of the psychosis. She gave, he believed, a history of alcoholism and her mental condition was that of one suffering from an alcoholic psychosis, which condition he stated was not uncommonly associated with and mistaken for pellagra."

"She had a peculiar, and, in its distribution, a very unusual dermatitis, the lesions being confined to the anterior portions of the neck and to the exposed portions of the wrists and back of the hands, bilaterally symmetrical. Dr. McCarthy's autopsy notes show nothing of a positive nature excepting the dermatitis and emaciation. The lungs were edematous and there was cloudy swelling of the kidneys. The intestines were congested about the cecum. There was no cortical atrophy and no areas of softening in the brain. Smears from the spleen and bone marrow were negative. The spinal cord and canal were also negative. The bone marrow of the femur was hyperplastic and the tonsillar crypts were filled with cheesy material. Microscopically the skin lesions were those of a superficial dermatitis. The lesions being confined to the corium and epithelium. There was a diffuse infiltration of the more superficial layers of the corium with round cells. Grossly this presented a broad desquamating surface with moist superficial patches of ulceration."

"Dr. Lawler mentioned that the patient had a dry skin with coarse tremors of the tongue and fingers. She wandered aimlessly about and had an ataxic one-sided gait."

"On the whole, comparing this case with the published accounts of cases elsewhere, the only symptom lacking was diarrhea; and in this case, Dr. Lawler noted that the feces were liquid in character and contained a few leucocytes and red cells. Dr. Drennan, who saw the case a few days before death, noticed that there was pytalism, that the patient did not cleanse her mouth of food, and that her teeth were covered with sordes. These, together with the nervous and mental symptoms indicated above, suggested very strongly that the case was one of pellagra."

Case II. History No. 67,437. Autopsy No. 1,897.

Dr. R. B. Nutter reported this case to the Society at its forty-fifth session, December 8, 1909.

A St. Lucian negress, age 30 years, married, employed as a washer-woman. Lived in Colon two years, and a few days recently in Gorgona. She was a user of rum, both in St. Lucia and on the Zone. History of two years pain in legs and knees. Lips, tongue, and gums indicate an acute stomatitis. Tongue was swollen and could not be protruded. A vulvitis was also noted. Hands, forearms, axilla, knees and perineum had a symmetrical dermatitis. There was profuse salivation and a diphtheritic

membrane on oral mucosa. Patient apathetic. Diarrhea and incontinence of urine were noted during the hospital stay. Mental depression increased rapidly. On the ninth day after admission she died apparently from exhaustion.

Dr. McCarthy's *anatomical record*: The mucous membrane of the colon was purplish red and had a few circular deep ulcers. The lower two feet of the ileum closely resembled the condition just described in the colon. The vaginal and oral mucosa showed an acute condition with patches of exudation. An intense acute degenerative nephritis seems to have been present from the description recorded. The left kidney weighing 335 grams, and the right one 285 grams (an edema of the cortex of the organs). Smears from intestinal ulcers negative except for flagellates. This case also presents the full syndrome, but the renal condition recorded is surprising.

Case III. History No. 78,786. Autopsy No. 2117.

A negress from Martinique, age 36. Local residence at Empire, but the length of her stay on the Zone was not known. Admitted June 16, 1910, and died June 21, 1910. Never in hospital before. Present illness recorded as of two months' duration. Chief complaint, difficulty in walking, a sore tongue and mouth for two weeks, and four months' amenorrhœa with some pain in abdomen on urination. Bowels had moved once a day. Tongue and mouth were a clean purplish-red. Vaginal mucosa tender and red, and there was a sero-purulent vaginal discharge. Reflexes were plus. Roughness of the skin of arms and pigmentation of the skin over the shins were noted but no acute dermatitis. A persistent temperature with an average of about 100 degrees and a gradual tendency upward to the terminal record of 107 degrees. The leucocytes were 10,400. Died five days after admission. Blood culture taken on day of death, sterile.

Anatomical Record: No skin lesions were found anywhere over the body except for some areas of thin, smooth, shining pigmented skin over the shins. The roof of the mouth, the gums, tongue, laryngo-pharynx, etc., were negative for lesions except for a small recent laceration of the under surface of the tongue where it had been in apposition with the sharp edge of a decayed tooth.

The brain and cord were as dry as paper and the ventricles contained very little fluid. The nerve roots (close to cord) were dotted over with opaque white "frost-like bodies." Smears of these crushed bodies were negative. Cultures showed on an

agar slant planted with these bodies a pure culture of a diplobacillus, which were gram positive and had no capsule. They appeared in white discrete colonies. Autopsy was performed one hour and five minutes after death. Omentum was rolled and attached to bladder and tubes and appendix. Pelvic adhesions numerous. A small myoma uteri present. There were adhesions over the liver and an interstitial hepatitis. Gall bladder was small and thick and contained two small, black, rough gall stones lying free in the gall bladder. The ducts were not occluded. A cloudy swelling of the viscera was noted. Judged by the findings at the time of autopsy (which occurred five days after admission), this case did not present the syndrome. The anatomical record on this case has been found to contain two typographical errors: (1) Chronic interstitial nephritis should read chronic interstitial hepatitis. (2) "Pigmentation of skins, localized," should read, "Pigmentation of the shins, localized."

Case IV. Case History 80,612. Autopsy 2,165.

This patient was a negro from Martinique, aged 40 years; local residence at Gorgona. He had been on the Zone four and one-half years. He was admitted to Ancon Hospital July 13, 1910, and died July 26, 1910. Occupation not given. He had been in the hospital eight months before for an operation. Present illness dated from that visit to the hospital. Had not been able to work. Complained of pain in joints and extremities, fever, no diarrhea, no cough. The physical examination recorded notes on palpable glands. Red, clean tongue, sclerotic vessels and an accentuated second aortic sound. Negative blood and stool. Urine: Hyaline casts. No albumin. W. C. B. 11,200. Patellar reflexes lost. Romberg's sign present. Had a stumbling gait. July 19, mouth and gums generally inflamed. Pyorrhœa alveolaris. Liver enlarged and tender. July 23, semi-coma. Abdomen tympanitic and rigid. Other muscles are somewhat tense. Tender over the sigmoid. Urine: Trace albumin and some casts. Died July 25, with the diagnosis of "Pellagra and Terminal Pulmonary Edema." On July 16, two 15-grain doses of quinin had been given hypodermically with an interval of three hours between doses. Blood cultures taken on July 25 reported sterile. The temperature had varied between normal and 101½ degrees until four days prior to death when a gradual rise took place, ending in the terminal record of 106 degrees. The stool record on the chart showed an average of six a day during the hospital stay.

Anatomical Findings: Principal finding was an acute and chronic colitis involving cecum, ascending colon, sigmoid and

rectum, and two shallow ulcers found in the appendiceal mucosa. Enlargement of the glands in the mesentery and mesocolon. The process suggested an entamœbic type of dysentery, but a search failed to reveal any specific cause for the lesions. (Body was 17 hours post mortem.) The degenerative changes in the other viscera leave the other descriptions of doubtful value. No operative scar could be found, but the scars in the testicles may represent the reason for the former visit to the surgical wards. The mouth and skin presented no lesions. The cause of death in this case was a dysentery and it had probably been of an entamœbic nature. This case cannot be considered as one presenting the requirements for pellagra.

Case V. History No. 80,915. Autopsy 2,168.

This case was one indicated as malaria, acute nephritis and pellagra. It occurred in a negro laborer, age 30 years, native of Barbados, who had lived on the Zone six years with his local residence at New Gatun. He was admitted July 18, 1910, and died July 30, 1910. Had been treated in Colon Hospital on two former occasions. Present illness of one week's duration. Chills, fever, vomiting, and cough. Constipation. Weak legs. Pain over spleen and both inguinal regions. Cervical and inguinal glands enlarged. Tongue coated and very red. Eyes jaundiced. Spleen enlarged. Accentuated heart sounds. Blood, c. a., malarial parasites. W. B. C., 23,000. Reflexes slightly plus. July 26, hicough and nausea. July 27, delirious. Requires restraint. Abdomen flat and tender. Constipated. An old condition of the skin showing pigmentation. No diarrhea since admission. July 29, pigmentation over entire body. July 30, convulsion. Blood culture, July 25, sterile. An irregular temperature. First nine days it varied from $97\frac{1}{2}^{\circ}$ to 100° .

Anatomical Findings: Malarial pigmentation of viscera. Mottled discoloration of skin of neck with a few ulcerated papules. Hands, arms, legs and feet show no variation from normal in the pigment present. On the inner aspect of the thighs are a few two-centimeter patches with increased pigmentation of the skin. Broncho-pneumonia, edema of the lungs, slight ulcerative enteritis, slight degree of ulcerative stomatitis, glossitis and esophagitis; arteriosclerosis. This case represents an undetermined infection and is barely open to question as a pellagra on the strength of the unknown etiology of the alimentary tract lesions, the indefinite pigmentation and terminal delirium. Some post-malarial element may have been the important factor.

Case VI. History No. 86,826. Autopsy 2,303.

A male Jamaican of 32 years. Local residence, Golden Green. Had been on the Isthmus for five years. Occupation, baker. Admitted to Ancon Hospital Oct. 22, 1910, and died Oct. 28, 1910. No former history entered. Present illness began 19 days ago with little blisters on the back of the hands, groins, scrotum and perineum, later spreading and leaving a dry crust. Physical examination reveals an ulcerated surface on the dorsum of both hands. Crusts in the groins. Macerated condition of skin over scrotum and perineum. Ulcerative stomatitis and glossitis. Chest negative. Slight trace of albumin in urine. Temperature range $97\frac{1}{2}^{\circ}$ to 101° . Stool record of three or four movements daily.

Anatomical Findings: A superficial acute entero-colitis. The spinal ganglia of the low cervical and high dorsal regions were swollen and red but microscopic examination revealed no recognizable lesion other than edema. A chronic marginal ulcerative glossitis and over the dorsum of the tongue were atrophic changes. Dental caries was most extensive. A subacute ulcerative symmetrical dermatitis over the dorsum of both hands and extending up the forearms half way to the elbows. The oozing from these surfaces had been marked. A similar dermatitis was found in the axillary and inguinal regions. The folds in the perineum were excoriated. A general lymphadenitis was found which was most marked in the axillary and inguinal sets. Cloudy swelling of viscera. Moderate degree of arteriosclerosis and chronic nephritis. Blood culture and spinal fluid sterile after six days' incubation. The cause of death was entered in this case as ill-defined, but the complete pellagrous picture was here represented except for the mental features and it will be considered among the cases of pellagra.

Case VII. History No. 88,680. Autopsy 2,355.

This case was not called pellagra by the clinicians, but since chronic colitis, dermatitis, vulvitis, vaginitis and starvation were entered as the chief clinical factors it will be analyzed with their series. A female negro from Montserrat, with a local residence for the past 24 years at Tabernilla. Age, 40 years. Admitted Nov. 26, 1910, and died Nov. 30, 1910. She had paid two former visits to the hospital (records of same were not at hand). Present illness of four weeks' duration, with fever, no chills, and pain throughout abdomen. There were nausea, anorexia, and diarrhea, with tenesmus. Physical examination revealed a tender abdomen, enlarged inguinal glands, clear red tongue, weak heart sounds, atonic skin and

prostration. The blood was negative. Stool not entered. Urine, none. Further notations showed a record of emaciation, stomatitis and a dermatitis (ulcerative) of perineum. Vulvitis and vaginitis were also mentioned. The uterus was recorded as fixed and retroverted. Temperature on admission 100° . It soon fell and maintained the subnormal average of $97\frac{1}{2}^{\circ}$. Stool record of five movements daily. Magnesium sulphate given on admission. No cause of death could be found at autopsy and it was entered as ill-defined. A moderate endometritis, cervicitis, vaginitis, and ulcerative colitis (cecum) were present and marked excoriation of the skin of perineum. A cloudy swelling of the viscera associated with general atrophy was noted. Dr. Darling suggested sprue, and since sprue and pellagra are said to be easily confused it will therefore be placed in the list of very doubtful cases of pellagra. It would seem probable that chronic pelvic disease was the primary factor of importance and that the present illness was its sequel. It was impossible, however, to establish a satisfactory cause of death.

Case VIII. History No. 90,849. Autopsy 2,419.

A male Barbadian of 39 years with local residence at West Culebra. Fourteen months on the Zone. He was admitted Jan. 10, 1911, and died January 27, 1911. Third hospital visit. Present illness of 12 days' duration. Chills, fever, vomiting. Constipation. Poor appetite. Cough. Pain in loins. No headache. Physical examination, rigid abdomen, jaundiced eyes, red denuded tongue, accentuated heart sound, knee jerks diminished. Blood, malarial parasite, W. B. C. 10,000, R. B. C. 3,584,000. Urine: casts and faint trace albumin. Stool, ascaris. Further daily notes, swelling of both parotids, but no tenderness. Dermatitis over back of hands and feet. Sores on penis and great swelling of foreskin and glands. Wassermann test positive. Inflammation of tongue and buccal mucosa, salivation. Blood culture sterile. An irregular persistent type of temperature with daily variation and an average of about 101° . Stool average of two movements daily.

Anatomical Findings: Broncho-pneumonia very extensive in right lung and less so in the left one. A fibrino-purulent pleuritis on both sides. Extensive cloudy swelling of kidneys, liver and heart. An acute fibrino-purulent tonsillitis and laryngopharyngitis. Congested intestinal mucosa. All glands enlarged and pink. Associated with these findings was the symmetrical dermatitis of the hands and forearms and a suggestive change of same nature about ankles and feet and a glossy atrophic epithelium of the tongue. The possibility is that an acute factor like the pneumococcus was the cause of death, but the tongue, skin, and emaciation may represent an associated pellagra. This

case will be entered as a pellagrin syndrome found in association with a positive Wassermann and a probable pneumococcus infection.

Case IX. History No. 99,065. Autopsy 2,589.

A negress from Guadeloupe, aged 40, and residence on Zone for three months at Gorgona. She was admitted to Ancon Hospital June 4, 1911, and died June 9, 1911. No former history of an illness. Present illness of 12 days' duration. Headache, fever, chills, vomiting and pain in the back; diarrhea.

Physical Examination. Enlarged liver and spleen. Coated, red tongue. Left submammary and arm dermatitis. Vaginal discharge and swollen vulva and a purulent discharge from urethra, vagina and rectum. Gonococci demonstrated. Blood: 14,000 leucocytes. Urine: Trace of albumin. No casts. Blood and pus in abundance. Stool: Blood and pus. June 8, delirious. Dermatitis under each breast and over the wrist. Blood culture: Pure growth of micrococcus aureus on all media. Temperature ran an average of $99\frac{1}{2}^{\circ}$ until the terminal rise of $106\frac{1}{2}^{\circ}$. Stool record of five movements a day.

Anatomical Findings: Yellow infarctions of kidneys and spleen. Acute degenerative nephritis. Acute enlargement of the spleen. Cloudy swelling of the liver and heart. In short, the findings of a virulent septicæmia. In addition there was chronic pelvic disease. The capsule and cut surface of the liver revealed contraction and the microscope confirms the presence of cirrhosis. The only mouth lesion found at autopsy was an ulcerated lower lip, probably the result of a bite. The vaginal lesion was gonococcic and the skin lesions were a typical and a symmetrical axillary, inguinal and submammary dhobie itch. The miliary petechial rash about neck and thorax was probably part of the septicemic process. It, therefore, seems fair to rule it out of the list of pellagrins.

Case X. History No. 103,266. Autopsy No. 2,714.

A negress from Martinique, about 47 years old. Has been on the Zone about five years. Local residence, Culebra. Admitted July 25, 1911. Died Sept. 3, 1911. Occupation, laundress. She had been in the Asylum on a former occasion. Admitted June 26, 1909, and discharged Sept. 13, 1910.

Diagnosis. Paranoid Dementia Precoc. On a later admission, was in Ward 17, July 25, 1911. Appeared to be in an apathetic melancholic state while there. Transferred to Asylum because of maniacal symptoms. Blood culture was sterile. Backs of hands, palms and wrists covered by a des-

quamating pigmented dermatitis. Same on the feet. Pyorrhea alveolaris, stomatitis and vaginitis noted. Stool: Blood and pus. The clinical diagnosis was entered as an Infective Exhaustive Psychosis with Chronic Nephritis and Pellagra.

Anatomical Findings: A characteristic dermatitis was found over the hands, forearms, ankles and feet. A slight chronic ulcerative endometritis, cervicitis and leucorrhea were present. Emaciation present to a marked degree. A moderate acute and chronic nephritis found and general atrophy of viscera was marked. No intestinal lesion found, but the chart shows a periodic diarrhoea not due to purgation. This case appears to have the complete syndrome.

Case XI. History No. 122,803. Autopsy 3,122.

He was a St. Lucian of 49 years, having spent the last 27 years on the Zone as a laborer. Local residence at Pedro Miguel. Admitted to Ancon July 5, 1912. Died July 6, 1912. This was his third admission. The last being two years ago. Present illness of six days' duration. Fever, chill, no vomiting, constipation. No appetite. Semicomatose on admission.

Physical Examination. Glandular enlargement. Atrophic skin. Cannot protrude tongue. Injected, jaundiced eyes. Involuntary urination. No diarrhea. Lips scarlet and puffy. Tongue and gums destitute of epithelium. Hands, feet and jaws deeply pigmented.

Anatomical Findings: This was apparently a very old negro with extensive dental caries and a pyorrhea alveolaris with dorsum of tongue atrophic and smooth. No cause of death could be assigned. No skin changes corresponding to the popular idea of a pellagrous dermatitis were noted, nor were any intestinal evidences present. An increase in pigmentation commonly found in the skin of old men of this race was noted. It would not appear to belong to the pellagrin class, but in the absence of proof of other cause for death and the presence of clinical data recorded, it might be held as a doubtful case.

Case XII. History 120,676. Autopsy 3,125.

A young negress of 22 years from Montserrat. Three years on Zone with local residence in Panama. Admitted June 1, 1912, and died July 8, 1912. Housework. "Out of her mind" once in Montserrat about 1907. Moderate alcoholism admitted. No children. No family insanity. Dermatitis appeared while in Wards 18 and 20 recently. Mind was clear then, but is deranged now. Skin over elbows and dorsum of hands and arms present the characteristic lesion. Vaginal, and all mucous membranes in-

flamed. Wassermann test negative. Temperature average was about 99° until the terminal rise during the last few days, which showed a range of $98\frac{1}{2}^{\circ}$ to $102\frac{1}{2}^{\circ}$.

Anatomical Findings: Entire oral cavity, the nasal passages and accessory sinuses, the esophagus, rectum and vagina revealed a lesion of an acute nature, and associated with this was a symmetrical dermatitis of the elbows, forearms and feet. A complete transition of the viscera in thorax and abdomen found. This case is recorded as a complete syndrome. A causative factor of any other nature was not to be determined.

Case XIII. History No. 1090-A. Autopsy 3,185.

A Jamaican negress, aged 40. Not known how long she had been on the Zone: Local residence at Colon. Admitted July 26, 1912, and died Aug. 11, 1912. A finding had been noted of pigmented dermatitis of elbows, wrists and back of hands. Stomatitis, vaginitis and proctitis had been indicated. Tender abdomen. Insane. Auditory hallucinations. Required restraint. Reported as having had six convulsions, transient in type with momentary loss of consciousness. Aug. 11, developed a temperature and cough. Stool average two daily.

Anatomical Findings: A broncho-pneumonia and acute purulent bronchitis were found which were extensive enough to be the immediate cause of death. A slight degree of contraction found in both kidneys. Two ulcers in the ileum, the type of which was not disclosed by smears or paraffin sections. The tongue had a smooth atrophic epithelium. There were marked pyorrhea alveolaris and extensive dental decay. An old laceration of the perineum and a urethral caruncle noted. Myomata uteri. Chronic cervicitis and salpingo-oöphoritis. All organs were atrophic. Emaciation extreme. A symmetrical pigmented exfoliative dermatitis of wrists and elbows and side of palms, but the regions involved were quite small and corresponded only to points of pressure. This has been placed among those looked upon as incomplete or doubtful cases. Chronic pelvic disease again seems likely to have played the important role.

Case XIV. History No. 126,077. Autopsy 3,212.

A male negro from Guadeloupe, age 40. Had been on the Zone six years. Local residence 181 Camp Bied. A laborer. Admitted to Ancon August 20, 1912. Died September 2, 1912. He had been twice in the hospital: once for malaria, and once for an injury. History of present

illness: Fever, headache, chills and cough. Complains of skin trouble over the hands and feet for past 15 days. Principal clinical findings were enlarged liver and spleen, and bronchitis. Skin over hands and feet was dry, rough and desquamating, appeared thickened and pigmented. Blood had malarial parasites (c. a.). Urine: Casts and large amount of albumin. Stool: Negative. Edema of feet and legs and some ascites. Systolic murmur at apex of heart. Average temperature was $97\frac{1}{2}$ degrees. Stool averaged two movements a day.

Anatomical Findings: Extensive chronic nephritis with cardiac hypertrophy and insufficiency of the mitral valve. Edema of the lungs. Arteriosclerosis advanced. Malarial pigmentation of the spleen and liver. Fatty metamorphosis and passive congestion of the liver. Congestion and edema of the mucosa of the colon. A dermatitis, symmetrical in character, was found on the dorsal surface of each hand and wrist. This case appeared to present the pellagrous syndrome in association with extensive cardio-renal disease.

Case XV. History No. 1111-A. Autopsy 3,247.

A Jamaican negress of 55 years, and unknown time on the Zone. Local residence in Colon. Admitted to Ancon September 14, 1912. Died October 7, 1912. Occupation, servant. An Asylum case. Kept in a straight-jacket until admitted to Ancon. No history. Poorly nourished woman of advanced age. Arteriosclerosis noted. Slightly inflamed tongue. Dry, scaly skin. Ulcer right leg, extensive. Knee jerks plus. Urine: A few casts and a trace of albumin. Stool negative. Wassermann negative. Clouded mind. October 2, oral cavity inflamed. Dysentery noted. Irregular temperature with an average of $99\frac{1}{2}$ degrees. Stools, three daily.

Anatomical Findings: The tongue, oral cavity, esophagus, rectum, vagina, endometrium, intestinal mucosa, all showed marked atrophy and in all but the intestinal mucosa were to be found a few chronic shallow ulcerative lesions. The skin lesions over the back of the hands and wrists had the proper appearance, but the lesions located in axillæ either had a dual etiology or were entirely due to dhobie itch.

Case XVI. History No. 126,750. Autopsy 3,335.

A Jamaican negress of 26 years. Lived on Zone one year with local residence in Panama. Housework. Admitted September 16, 1912. Died January 10, 1913. Irrational on admission to Ward 19, and transferred to Asylum. Ran a typhoid-like course with delirium. Delusions of persecution. W. B. C. 10,100. Blood negative. Diarrhea. Stools contained blood and pus. No dermatitis.

Anatomical Findings: Extensive ulcerative ileo-colitis. An etiological factor could not be demonstrated. Glands of mesentery and mesocolon were acutely enlarged. The lesions resembled those of typhoid fever, but cultures failed to establish such a diagnosis. An acute and chronic vaginitis and cervicitis of gonorrheal origin was found. No skin lesion present. Case rejected as a pellagrin.

Case XVII. History No. 1,169-A. Autopsy 3,369.

A male Jamaican of 36 years. Local residence, Colon. Stay on Zone 1. Admitted January 17, 1913, and died February 2, 1913. A laborer. Transferred from Santo Tomas. Memory defect, but no fixed hallucination. Knee jerks plus. Tremor of fingers and slight incoördination of extremities. Urine: Faint trace albumin; no casts. Presented evidence of premature age. Alcoholism admitted by friends. Incontinence of feces and urine. Temperature average 100 degrees. Stools, two daily. A desquamation and pigmentation of the (L) hand had been entered as questionable. A short time before death the tongue became red and beefy. Bed sores developed and patient passed into a state of muttering delirium. The case was too postmortem for detailed description, but from the general findings, and the character of the skin and mouth lesions, this instance would hardly fall within the list.

Case XVIII. History No. 1,071-A. Autopsy 3,373.

A negress of 40 years. Native of Nevis. Local residence, Guachapali. On Zone one year. Admitted June 6, 1912. Died February 6, 1913. A domestic. Brother states that she began to act queerly about the middle of March, 1912. Delusions of persecution. Mother was melancholic. Father alcoholic. Children normal. In Ancon Asylum once before (March 19, 1912).

Physical Examination: Superficial ulcer on palate. Sluggish pupils. Blood negative. Urine: Trace albumin; no casts; trace Indian. Wassermann negative. June 28, 1913, pellagrous state developed. Stomatitis with salivation, vaginitis. Frequent loose stools and a notation of mental confusion. Dorsal surface of hands showed dermatitis. A daily rise in temperature to about 100 degrees. Stools, average of three a day.

Anatomical Findings: A chronic ulcerative process found in cecum and transverse portion of colon with focal acute exudative areas in the last-named portion. Lower end of the ileum had a few chronic ulcers of undetermined type. In the posterior end of the urethra and at the exit of bladder was an acute inflammatory process. Marginal atrophy of the tongue. Extensive decay of teeth with pyorrhea alveolaris. A senile state with

general atrophy. No skin lesion. No leucorrhea. The symptom complex and anatomical findings did not seem complete in this case.

Case XIX. History No. 1,155-A. Autopsy 3,376.

A Panamanian of 35 years. Born in Panama and had maintained his local residence in Panama. Admitted December 27, 1912. Died February 9, 1913. Policeman. He had been detained as a case of infective exhaustive psychosis in the Asylum. Transferred from Santo Tomas Hospital. No history. No special hallucinations or delusions. Slight desquamation of knuckles, and the extended fingers showed a tremor. Tongue furred. Came to Asylum in straight-jacket. Very weak. Mental confusion. Disoriented for time and person. Denies being ill and does not understand why he was detained. Alcoholic history. January 30, tongue became red and inflamed. Skin lesion on knuckles still persists. February 6, stomatitis. Difficulty in swallowing. Bowels loose. February 8, signs of pleuritis on right side. Ineffectual cough. Odor of breath suggests gangrene. Pulse and respiration rate increased. Cyanosis. W. B. C., 8,400. Ran an irregular septic type of temperature. One stool a day the average.

Anatomical Findings: Gangrene of the right lung. An acute exudative pleuritis, bronchitis and tracheitis. Broncho-pneumonia of massive type about the cavity. An intense cloudy swelling of all viscera. One small acute ulcer in rectum. The usual bad teeth and mouth and smooth surface to tongue. The character of the knuckles lesion looked like the pigmented scaly zone about a healing exposed wound of skin. The findings would not admit of classification under pellagra.

Case XX. History No. 130,701. Autopsy No. 3,434.

A Jamaican negress, aged 30 years, with local residence at Empire. Three years on Zone. Admitted November 15, 1912, and died April 1, 1913. Housewife. Ill for the past year with diarrhea at intervals. Has grown worse in last two weeks. Tenesmus with diarrhea. Claims history of rash on arms and hands and sore mouth. Hemorrhoids with fissures and excoriations. Vaginal examination normal. Tenderness over right kidney. Stool contains blood and pus, but is negative for typhoid and amœba. Blood culture sterile. Positive Wassermann and Widal tests. Neosalvarsan given. Septic type of temperature. Five or six stools daily. *B. coli* in urine cultures.

Anatomical Findings: A very extensive acute diffuse pyonephritis. An acute and chronic ulcerative proctitis with a stricture probably syphilitic in character. These were the prin-

cial lesions found. All findings can be satisfactorily explained by the two infections, *B. coli* and syphilis, and there appeared to be no associated factors suggesting pellagra.

Case XXI. History No. 145,248. Autopsy 3,566.

A West Indian negress of 49 years. Has been 25 years on the Zone. Local residence, Golden Green. Occupation, housework. Admitted July 15, 1913, and died July 27, 1913. Sick for three weeks. Eruption on back of hands and arms. Irregular attacks of diarrhea, sore throat, and salivation. All mucous membranes involved. A skin lesion found under breasts, in groins and perineum, and to a small extent in axillae. Stupid.

Anatomical Findings: The dermatitis of hands, forearms, neck and breasts appear to be characteristic, while those of groin and axillae appear to be of a different character. The perineum is excoriated, probably caused by the leucorrhea. A skin change in left malar region also appears characteristic. Syphilitic vascular changes noted in aorta. The mental, cutaneous and intestinal manifestations are all present.

Case XXII. Case History No. 146,177. Autopsy No. 3,574.

A negress from Martinique. Age 36 years. One year on Zone. Local residence at Pedro Miguel. Housewife. Admitted July 29, 1913, and died August 1, 1913. Indefinite history. Sick since July 25. Two chills. Fever, nausea, vomiting, and pain in abdomen. No cough. Bowels move four times in one day. Headache. No skin or mental association. Average temperature 101½ degrees.

Anatomical Findings: An extensive *B. coli* pyelo-nephritis, bilateral. Ureters, urethra and bladder involved. Extensive cloudy swelling. Acute splenic tumor. Focal necrosis of liver. Recent operative wound of abdomen with absence of appendix. No pellagrous elements present.

Case XXIII. History No. 148,463. Autopsy No. 3,615.

A male Jamaican with local residence at Cowpens-Culebra.. Three years on Zone. Age 29 years. Admitted September 5, 1913. Died September 10, 1913. Laborer. Sick five months. Diarrhea and tenesmus. Pain in abdomen. Sore mouth. Skin lesions on dorsum of hands, wrists and neck, forehead and scrotum. Mucous membrane of the rectum inflamed. Temperature range 98 to 104 degrees. Average about 101 degrees. Stool, daily average of two.

Anatomical Findings: Chronic ulcerative colitis of rectum and sigmoid. An acute general exudative esophagitis and stoma-

titis. An acute and chronic glossitis. Acute tonsillitis, bilateral. Characteristic skin lesions found on back of hands and wrist, on the forehead and neck, on the left ear and malar region, on scrotum and penis, and between shoulders on the back, and in right lumbar region. Broncho-pneumonia. A syphilitic process in aorta with multiple marble sized aneurysms. Accepted as pellagra associated with tertiary syphilis.

Case XXIV. History No. 1,254-A. Autopsy 3,641.

A Jamaican negress of 70 years with local residence at Pedro Miguel. Length of stay on Zone? A laundress. Admitted July 8, 1913, and died September 23, 1913. Became demented June 5. Principally religious delusions. Has had four miscarriages and two children. Corneal opacity of right eye. Arcus senilis. Marked arteriosclerosis. Skin lesion under arms, over abdomen, pubis and thighs. Wassermann positive. Stomatitis and facial dermatitis. Areas of dermatitis on back of hands and feet. Frequent stools and mental confusion. Stools average four daily.

Anatomical Findings: Gummata of liver. Syphilitic aortitis. Syphilitic osteo-periostitis right tibia. Arteriosclerosis advanced and general. Generalized atrophy. Skin lesions on dorsum of left hand and foot of chin and of elbows and abdomen. No intestinal lesions other than scars in colon and presence of intestinal parasites. Accepted as doubtful pellagrin associated with syphilis. Skin lesions not characteristic.

Case XXV. History No. 1,292-A. Autopsy 3,664.

A male Barbadian of 35 years. Local residence in Guachapali. Two years on the Zone. Admitted September 26, 1913, and died October 11, 1913. Occupation, tailor. Alcoholic history. No previous attacks. Tremor of fingers. Knee jerks diminished. Poorly nourished. Shaky. Weak voice. Mental confusion. Admits drinking to excess for a long time. Ill for three months. Says he was poisoned. October 2, 1913, stomatitis. Average temperature about 100 degrees. Stools, two.

Anatomical Findings: An emaciated male negro with keratosis follicularis over chin, cheeks and nasal regions. A small tuberculous cavity in right apex. Some miliary abscesses in liver. The peribronchial glands are tuberculous. A moderate chronic nephritis. Not accepted as pellagra. Microscopic examination later revealed a tuberculous process, but the miliary tubercles were sparse in all tissue except the right lung.

Case XXVI. History No. 1,296-A. Autopsy 3,666.

A female Panamanian of 28 years. Local residence, Panama City, life on Zone. Admitted to Ancon Hospital by transfer from Santo Tomas Hospital on October 7, 1913, and died October 16, 1913. A diagnosis of infective exhaustive psychosis, nephritis, diarrhea and pellagra. Married woman with five children. History of alcoholism. A laundress by occupation. No previous attack. Taken to hospital by police. History of diarrhea and insanity of recent date. Vaginitis, proctitis, red tongue and dermatitis of the third, fourth and fifth toes on each foot. Temperature range 98 to 103 degrees, average $100\frac{1}{2}$ degrees. Stools average 6 (f).

Anatomical Findings: An acute exudative colitis and appendicitis of a most extensive degree resembling bacillary dysentery. No vaginitis and no mouth disease other than bad teeth. Toxic condition probably the only cause of insanity. There was emaciation and a peculiar pigmented and purulent dermatitis involving the fourth toe of each foot and internal aspect of each fifth toe and external aspect of each third toe. A very doubtful skin manifestation.

Case XXVII. History No. 148,759. Autopsy 3,670.

A female Barbadian of 28 years. Local residence in Panama City and length of stay on Isthmus four years. A seamstress by occupation. She was admitted to Ancon Hospital on September 10, 1913, and died October 17, 1913. Her mental condition caused the admission to the hospital and a history of alcoholism accompanied the case. Otherwise no past history could be gotten.

The prominent features in the physical examination were ataxic gait, sluggish pupillary reaction, enlarged epitrochlear and inguinal glands, some albumin and casts in urine, with occasional presence of indican and pus. Temperature range of 99 to 100 degrees. Pulse average 94, and a respiratory average of 24. Stools, two a day. Hallucinations, auditory and visual, were established, and she possessed ideas of persecution.

The *anatomical findings* disclosed the well-nourished body of a black female with an old median line laparotomy scar above the symphysis pubis. A suspension of the uterus had been done at some former time. The principal finding appeared to be meningeal in character. Large and small coin-shaped areas of chronic pachymeningitis were present and the remainder of the brain and cervical portion of spinal cord were covered with a hemorrhagic, almost transparent gelatinous substance. A culture and smear study, as well as paraffin sections, failed to offer

an etiological factor. No Wassermann test had been taken and the serum was not in good enough condition to warrant a test on the cadaver. A chronic otitis media on the left side and a sero-purulent maxillary sinusitis on the same side were found. Some acute change in the lymph nodes of the submaxillary and upper cervical sets.

Old fibrous adhesions were present over spleen and liver and in the pelvis. Also some fibrous bands between abdominal wall, uterus and rectum were found. A moderate albuminoid degeneration of the liver, heart and kidneys existed. These are the points disclosed at autopsy. It is true that nervous symptoms and a form of insanity were present, but its etiology cannot safely be entered against pellagra. The gastro-alimentary and cutaneous manifestation were entirely absent. Her well-nourished state and the otitis media and sinusitis so strongly indicate a succession of events leading to a chronic meningitis that it seems wise to reject the case as a pellagrin.

Case XXVIII. History No. 151,396. Autopsy 3,699.

A female Barbadian of 38 years, having lived on the Isthmus for six months with a local residence in Panama City. A domestic servant. She was admitted to Ancon Hospital October 26, 1913, and died November 2, 1913. She was in the hospital for thirteen days in July and August of the same year. A clinical diagnosis of pellagra was made on each occasion. The chief complaint was stupor, vertigo and weakness.

The physical examination also revealed some enlargement of the superficial gland sets but nothing of importance in the thorax or abdomen. Blood examination: H. C. 45% W. B. C. 12,400. Urine: 1,025, few hyalin and granular casts and a trace of albumin. She talked only in a whisper because of sore mouth. Wassermann test was negative. Eye grounds were reported as normal. Old cervical laceration and injected vaginal mucosa. On October 27, evidence of a characteristic cutaneous lesion noted on both elbows and the dorsum of the hands. Reflexes slightly increased. October 29, 1913, skin lesions gone. Another Wassermann test negative. Spinal fluid negative. W. B. C. 15,000. October 31, 1913, mind clear. Defecation and urination involuntary. Temperature range 96 to 106 degrees, the average being about 100½ degrees. Pulse 108. Respiration 28. Stool, one daily.

Anatomical Findings: There was a slight thickening and increased pigmentation of the skin over the dorsal surface of the knuckles on the fingers, but this is almost an everyday occurrence

in the black women leading such a domestic life. The oral symptom only appeared in the terminal stage of the illness, and the lesions were like those commonly found toward the end of many acute infections in which the teeth are in poor condition and an active pyorrhea alveolaris has existed. The tonsils and the mucosa of the laryngo-pharyngeal pouches were acutely inflamed, but no common factor could be found. The tongue lesions were marginal and in apposition with bad teeth. A marked retroversion of the uterus was present and a lacerated eroded cervix. The brain presented a small cicatrix in the left occipital lobe. There was softening of the splenic pulp and enlargement of the malpighian bodies, but no increase in size of the organ. A cloudy swelling of liver, heart and kidney was noted. The general indications were those of an acute infection, yet the culture from the spleen only offered *B. coli*, and that was open to question as a post-mortem invasion.

It would not seem probable that the case was a pellagrin, but since the autopsy did not reveal a clear cause, and since a late stomatitis and mental derangement were present in association with a clinical notation about the cutaneous state of the hands it will be placed in the doubtful group.

Case XXIX. History No. 151,863. Autopsy 3,700.

A female Jamaican of 36 years. Local residence, Empire; duration of stay on the Zone, five years. Admitted to the hospital November 3, 1913, and died two and one-half hours later. So far as is known her occupation was that of a domestic. No clinical diagnosis was made. She had been delivered of a child four months ago. Three weeks after this delivery she became sick and for some time had had a sore mouth, some fever and a moderate diarrhea.

Physical Examination: A fine membrane had formed over the entire oral mucosa and a state of salivation appeared to exist. A characteristic dermatitis was present on the exterior surface of the hands and forearms and on the elbows. The skin over the body had a maculo-pustular eruption. A thin desquamation was taking place on the soles and palms. Vaginal mucosa red and a watery discharge was present. She was stuporous and very weak. Blood stream: Negative. No entry of stool and urine. Temperature 101 degrees. Pulse 84. Respiration 28. Stool 0.

Anatomical Findings: Typical cutaneous lesions were present over the extensor surface of the forearms, hands and fingers, on the malar regions and the forehead. An acute reddened and

granular oozing mucous membrane was found everywhere in the oral cavity and extended into the oesophagus. Vaginal wall was in a similar state, plus the presence of a chronic ulcer high in the vault. Softening of the spleen without enlargement noted. Cloudy swelling present. The uterus, except for a moderate malposition, was normal. The failure of cultures on mouth and spleen to establish a factor for the disease leaves this case to be included among the positive cases of pellagra. No Wassermann test.

Case XXX. History No. 153,124. Autopsy 3,740.

A female St. Lucian of 76 years having lived on the Zone for 20 years. Local residence at Culebra. Has always performed the duties of a housewife. Had been ill two weeks with fever, chills, pain in back and abdomen. Salivation and diarrhea.

Physical Examination: A divergent strabismus, a fibrosis of the superficial vessels. Superficial gland sets enlarged. A foul-smelling, sore mouth. Atrophic skin and a cutaneous lesion over back of hands and feet suggesting pellagra. Purulent conjunctivitis. Excoriation of the skin and mucous membrane of external genitalia. Semi-coma. Evacuations involuntary. Irregular moderate elevation of temperature averaging 101 degrees; pulse 116; respirations 24; and stools 2.

Anatomical Findings: Wasted body of an old negress. Bilateral strabismus. Red granular conjunctiva and a muco-purulent discharge from same. Excoriation of the vulva, perineum and buttocks. A well-defined exfoliative dermatitis over the dorsal surface of hands and fingers. Increased pigmentation and thickening of the skin over the elbows and extensor surfaces of feet and ankles. The significant mouth findings were dental decay, pyorrhea alveolaris and atrophy of mucosa of tongue and a film-like membranous formation over buccal mucosa. There had been very extensive pelvic inflammation for tubes, ovaries, uterus and rectum were all in one hard fibrous mass and an anal fistula had become established. An acute and chronic urethritis and cystitis were present. Arterio-sclerosis was advanced and general, and in the left half of the pons and medulla was an area of softening, noticeable on gross examination.

This is the type of case in which it would seem quite possible for the pellagrous tripod to appear as a sequel to the old condition present, but it will be admitted and considered as an associated disease.

Case XXXI. History 1,330-A. Autopsy 3,769.

A male Jamaican of 30 years. Length of stay on Isthmus unknown. Occupation, barber. Local residence, Panama City. He was admitted to the Ancon Asylum December 19, 1913, and died December 26, 1913. He had been first admitted to Santo Tomas Hospital with a history of three weeks illness. History of alcoholism. Diarrhea said to have been associated. No previous attacks. The inguinal and femoral glands were large and hard. The knee reflexes exaggerated. Unable to walk. Poorly nourished. Pain in abdomen. Seems clouded mentally. Stool: Pus and blood present. Urine: 1,030; negative for casts and albumin. Temperature ran a sub-normal course with an average of $96\frac{1}{2}$ degrees. Pulse 84. Respiration 18. Stools average two a day.

Anatomical Findings: The colon, ileum and stomach revealed a chronic ulcerative process, yet its type did not suggest any etiological factor, nor did the smears, cultures or microscopic examination of sections reveal a factor. The buccal mucosa and roof of mouth had a sand-like roughening, but no definite ulcers and no membrane. There were no cutaneous lesions. The end-results of ulcerative process in the gastro-alimentary tract and of excessive alcoholism bid fair to be the factors back of the psychosis. The case does not appear to warrant the diagnosis of pellagra.

Case XXXII. History No. 1,343-A. Autopsy 3,837.

A female Barbadian of 32 years. Duration of stay on Isthmus eight years. Occupation, housework. The case had been admitted to the hospital January 8, 1914, and died on February 11, 1914. She had a history of insane periods in 1911 and 1913, each time occurring in December. There was a history of alcoholic debauches prior to each of these attacks, which lasted from three to ten days. She was violent during attacks. No children or miscarriages.

The clinical investigation revealed a stomatitis, indicanuria, and a positive Wassermann test. Other entries all normal except for the psychosis (the mother died in a "mad house"). Late in her illness a diarrhea developed with blood or pus in the stool. Abdominal pain present. Temperature ran an average of 100 degrees. Pulse 108, respiration 26, stools 3.

Anatomical Findings: No cutaneous lesions were present. The condition of the teeth and alveolar processes were such that they seem to easily offer cause for the stomatitis noted. The nervous manifestations were probably due to the chronic meningo-encephalitis involving the frontal, parietal

and temporal regions of the brain. A gummatous-like formation found in the left gasserian ganglia. Chronic ulcers of rectum, bladder and endometrium were found and acute and chronic salpingo-öophoritis. Wassermann test was positive. Syphilis and pelvic inflammatory disease seem quite sufficient to cause the nervous manifestations, and the mouth lesion surely had ample cause for appearance when the state of the teeth is considered.

Case XXXIII. History 157,738. Autopsy 3,845.

A female Barbadian of 30 years. Duration of stay on Zone, two months. Local residence, New Gatun. Occupation, housework. Admitted to hospital February 14, 1914. Died February 19, 1914. History of five months illness, slight cough and loss of weight. Sore mouth and throat. Falling out of hair in patches. Hallucinations.

Physical examination revealed fibro-myomata-uteri. Stomatitis and salivation. Cardiac enlargement and a murmur systolic in time at apex. Harsh pigmented skin over wrists, anterior and posterior surfaces. Blood: H. C. 50%. Lts. 9,000. Red cells 3,000,000. Urine 1,015; trace albumin and a few casts. Stool: Blood and pus present. Sero-sanguineous discharge from vagina. Wassermann test positive. Treatment instituted. Blood culture sterile. Temperature curve 100 to 105 degrees. Pulse 132; respiration 40, and stools, 1 daily.

Anatomical Findings: There was a huge mass of myomata uteri, and one large one had broken down and a fistula established into the uterine cavity. Marked mechanical interference on sigmoid flexure; areas of pachy-meningitis; a chronic syphilitic endocarditis with aortic insufficiency and plaque formations in intima of aortic arch. Loss of hair on scalp in annular patches. A cyst of small size in pituitary gland. Large puckered cicatrices in liver, spleen and kidneys. The poor dental condition was again a prominent feature. No cutaneous lesions.

The decayed teeth, the syphilitic process, and the myomata uteri seem sufficient to explain the factors suggesting pellagra.

Case XXXIV. History No. 149,590. Autopsy 3,852.

A female Jamaican of 45 years, with local residence at Palmetto. Duration of stay on Isthmus, three years. Occupation, housework. Admitted to hospital September 17, 1913; died February 24, 1914. Sick for one year. Numbness, weakness, diarrhea. No fever, chills, or headache.

Physical Examination: Palpable inguinal and axillary glands. Knee reflexes diminished. Urine 1,016; granular and hyalin casts and trace al-

bumin present. Stool: Ova of uncinaria and tricocephalus found. Wassermann test negative. Sputum positive for tubercle bacillus. The usual type of tuberculous temperature. A drop to near normal in the A. M. and a rise in P. M. Pulse 118; respiration 28; stools, 3 a day.

Anatomical Findings: A white bran-like desquamation of the skin over all extremities, such as is frequently seen in emaciated individuals with an atrophic skin. Aside from this a widespread dissemination tuberculosis was found. The intestinal ulcers no doubt causing the diarrhea.

Case XXXV. History 156,489. Autopsy 3,875.

A black female of 21 years who had spent her life on the Isthmus, being born on the Isthmus of Jamaican parents. Local residence, New Gatun. Occupation, housework. She was admitted to the hospital on January 22, 1914, and died March 18, 1914. No history of past or present illness. Mildly excited and has hallucinations. Temperature curve 99 to 103 degrees. Pulse 128, respiration 30, stools, 2 a day. Wassermann test on blood and spinal fluid negative. Blood culture sterile. H. C. 30% W. B. C. 15,000. Stool, negative.

Some days after admission husband stated that she had been ill one month. An alcohol habitue; showed illness only by disturbed sleep and ideas of persecution. Was in Colon Hospital a year before for an attack of fever. Mother was an alcoholic habitue. Patient had never been pregnant. Later a tremor of lips and fingers became pronounced and reflexes were diminished. Stools were of pea soup consistency. January 31, stomatitis developed. Mental state had become less violent. February 26, elbows show roughened pigmented skin. Defecation and urination involuntary. March 18, skin of wrists is now pigmented; teeth are loose and gums inflamed.

Anatomical Findings: A characteristic dermatitis was found in a symmetrical manner on elbows, fingers and wrists, trochanteric regions, each external malleolus, each second toe, the patellar region, and the point of chin. Aside from cloudy swelling and stomatitis no other lesions were present. Cultures from spleen and a study of the paraffin microscopic sections revealed no known disease factor.

Case XXXVI. History No. 1,345-A. Autopsy 3,927.

A female Jamaican of 38 years. Duration of stay on Isthmus, five years. Local residence, Panama City. Occupation, domestic. Admitted to hospital January 14, 1914; died May 2, 1914. Was mildly insane in 1913. She was a hard drinker. Had ideas of persecution. Had been arrested while in some of these attacks. February 27, diarrhea with blood

and pus but no factor could be found. April 22, 1914, developed stomatitis and vaginitis. May 1, 1914, diarrhea had continued; vomits occasionally. Wassermann test positive. Slight elevation of temperature, averaging 100 degrees. Pulse 128; respiration 24; and stools, 4 a day.

Anatomical Findings: Briefly summarized the principal items were as follows: Amœbic colitis; degenerating fibromyomata uteri; abscess of Bartholin's gland (left); fistula-in-ano; moderate degree of chronic nephritis; adhesions over spleen and liver; exostosis of inner table of skull, and gallstones. The thumbs had a greasy pigmented thick skin, but did not suggest anything but an occupational factor as its cause.

Case XXXVII. History No. 162,588. Autopsy 3,958.

A male negro from Antigua; 34 years old; living on the Isthmus for ten years, with a local residence at Empire. Occupation, corral-helper. History of one month's illness. Diarrhea, pain in abdomen and sore mouth. The physical findings were: Sore mouth, a stuporous state, diarrhea, and an excoriated patch on scrotum and perineum. Entire mouth inflamed and bleeding. Stool revealed no etiological factor. Blood normal. Urine, 1,010; hyaline and granular casts; trace of albumin. Temperature, 97 to 101½ degrees; pulse 118; respiration 32; stools, 5 in two days after calomel and mag. sulph. were administered.

Anatomical Findings: The principal feature was the red bleeding mouth and a diphtheritic membrane in the laryngopharyngeal recesses. This was a gray membrane quite similar to that usually found in diphtheria, and despite the nature and history of the mouth lesion cultures were made from this low pharyngeal region for diphtheria bacilli. The result was *positive*. A marked cloudy swelling was present in the viscera. There were no skin lesions aside from some small axillary patches of "dhobie itch." Pellagra is not considered a factor in the case. Culture from spleen sterile.

Personal conclusions drawn from a survey of the autopsies, as well as the clinical records which accompanied the cadavers, would lead me to include as positive cases the following: Cases I, II, VI, VIII, X, XII, XV, XXI, XXIII, XXIX, XXX, XXXV; cases open to question: V, VII, XI, XIII, XIV, XXIV, XXVIII.

Thus, from a list of 37 cases, 12 appeared to answer the requirements and 7 were accepted as doubtful cases.

These appeared according to nativity in the following order :

Jamaica	8
Barbados	3
St. Lucia.....	3
Montserrat	2
Martinique	1
Guadeloupe	1
Unknown (West Indian negro).....	1

The length of residence on the Isthmus varied in the accepted cases as follows :

6 months to 14 months.....	2
3 years.....	2
5 years to 6 years.....	5
20 years to 25 years.....	4
Life time.....	1
Unknown	5

It will be seen that at least five of the cases were on the Canal Zone from 20 years to a lifetime. The lifetime instance occurred in a black female of 21 years, who was born on the Isthmus and spent her life continuously on the Isthmus. Both parents were Jamaican.

Local Residence.

The cases appeared more or less evenly distributed over the Canal Zone when the inhabitants of the various communities are taken into consideration.

Ages.

Up to 20 years.....	0
20 to 29 years.....	3
30 to 39 years.....	7
40 to 49 years.....	6
50 to 59 years.....	1
60 to 69 years.....	0
70 to 79 years.....	2

The majority occurred between the years of 30 and 50; the youngest being 21 years and the oldest 76 years. It is a very significant fact that no cases occurred among the children.

Sex.

Males	5
Females	14

The sex incident corroborates the findings of the Thompson-McFadden Commission. When the preponderance of the male element on the Canal Zone is recalled it will be seen that this is a feature of unusual interest. In the early years of the Canal construction very few West Indian women were on the Zone.

Occupation.

Chiefly that of indoor work, while a few were outdoor day laborers.

Seasonal variation as to onset of the disease was not significant.

Only two of the cases gave a family history that might indicate the presence of the disease in other members of the family. It must be admitted, however, that family history, or even the personal history of past illnesses, can only be very unsatisfactorily arrived at in these people, so that evidence of contact possibilities is practically unknown to us. The hospital stays and the history of onset were nearly all short for this disease.

The chief diseases found in association were:

Syphilis, alcoholism, chronic pelvic disease, colitis, nephritis, cardiac disease, arterio-sclerosis, tuberculosis, gonorrhea and various forms of long standing mental disease. Malarial pigment was quite commonly present in smears made at autopsy from the spleen and rib marrow. The presence of one or more types of intestinal parasites was almost universally found.

In reviewing the clinical records covered by the same period of time, no clear-cut case of pellagra could be found recorded in a Latin-American individual, or in children, or any individual of the white races. Animal inoculations that have been done at the laboratory with blood, spinal fluid and excretions from the more typical cases of pellagrins in this anatomical series (both before and after death) have in all but one instance proved fruitless. In one monkey a tail dermatitis and loss of hair appeared, but its cause is not clear to us, and is believed to have occurred too promptly to have been related in any way to the disease under discussion.

A histological and bacteriological study has also failed to offer

any finding that would throw light on the etiology of the disease or in any way help to differentiate it.

To one who draws conclusions from this particular series of cases there would seem to be a striking association of the pellagrous syndrome with tertiary syphilis. It would seem that syphilis, advanced arteriosclerosis, alcoholism, and any other disease which might affect the central nervous system in a chronic manner, might have as a sequel at times just such a tripod of manifestation.

If there be a specific factor in connection with this syndrome, then conditions on the Canal Zone, from the standpoint of insect transmission, are pretty well kept under control, for the disease has not appeared in an unquestioned type in American or natives, being entirely confined to West Indian adult negroes and to one adult negro of Jamaican extraction. This one case, however, would appear to prove the possibility of the disease being indigenous, notwithstanding the fact that the other cases may appear to be imported ones. Even the cases with a history of 20 years or more residence on the Zone are not considered by some authorities to indicate the receipt of the infection in the country in which they at present reside.

Summary.

(1) The complete pellagrous syndrome was only found in West Indian adult negroes and one adult negress born on the Isthmus of Jamaican parents.

(2) Length of residence on the Isthmus has varied from six months to a lifetime, the average time for most of the cases being about five or six years.

(3) Local residence on the Isthmus: The victims came to Ancon Hospital from all parts of the Canal Zone in about equal numbers when the population of the various communities is considered.

(4) Age: Nearly all cases occurred between the ages of 30 years and 50 years. The youngest was 21 years and the oldest 76 years. It is very significant that no children have occurred in this list nor in the clinical records of the hospital.

(5) Sex: Reference to the Canal Zone census will reveal the sex incidence on the Zone, and will show how very striking is the preponderance among the females of this disease.

(6) Occupation: Nearly all the individuals were either employed as housewives, domestics, or in some public building, save for a few outdoor laborers.

(7) Seasonal incidence in regard to the onset of symptoms was not significant.

(8) Diet: Chiefly vegetarians, fish largely taking the place of the usual meat eaten by other races on the Isthmus.

(9) One case had spent the entire life on the Zone. This individual was the offspring of Jamaican parents. Four cases had spent twenty years or more on the Isthmus. These instances offer some evidence that the disease is indigenous. The absence of children, American or other white people, and of natives, would appear to refute the possibility. The present sanitary methods may also operate against its dissemination among members of the better-kept class of inhabitants.

(10) Histological, bacteriological and inoculation observations have not offered any data in the more typical cases studied, that would help to reveal an etiological factor or prove that the disease is an entity.

(11) The striking association of this condition and such diseases as syphilis, excessive chronic alcoholism, arterio-sclerosis, starvation, chronic pelvic inflammations, and various types of chronic intestinal inflammations would make it seem plausible that this syndrome might frequently be a sequel to these conditions.

(12) An unassailable diagnosis of this disease can only be established at present by the coincident occurrence in an individual of a peculiar type of chronic gastro-intestinal, cutaneous and nervous symptoms that cannot be explained by the presence of some known pathologic agent.

(13) If pellagra is an infectious disease, then there must exist on the Canal Zone some unique factors which govern its incidence among the adult female West Indian negroes.

(14) The general incidence of the disease in this region is not high.

NEWS AND COMMENT

The State Board of Health of Florida is erecting a laboratory at Jacksonville at a cost of \$20,000.

Dr. Isaac Brewer has left Taughannock Falls, N. Y., and is now living at the Woodlie, Washington, D. C.

Since January 1, 1914, there have been 2,136 cases of bubonic plague in Hong Kong, with 1,986 deaths.

Dr. Allan J. McLaughlin, U. S. P. H. S., has assumed his duties as health commissioner of Massachusetts.

Dr. J. F. Siler, Capt. M. C., U. S. A., has moved from Spartanburg, S. C., to the Army Building, 39 Whitehall street, New York City.

Dr. Walter G. Baetz, who has been serving at the Ancon Hospital, Canal Zone, has opened offices in Richmond Hill, New York City.

A new hookworm station has been established on the Isthmus of Panama by the Rockefeller Hookworm Commission. Of the first 1,000 examined, 700 were infected.

Professor Rudolf Emmerich, chief of the department of bacteriology and hygiene, Königliche Bayrische Ludwig-Maximilians Universität, Munich, Germany, died recently.

There are said to be several thousand cases of cholera in Galicia and Hungary, on account of which it is reported that the Russian army has been compelled to withdraw from the country.

Two passengers arriving in Havana on November 16 on the steamship "*Esperanza*" from Progreso, Mexico, were isolated on account of yellow fever. Two other cases were reported from Merida, Yucatan.

For the third successive year, Dr. C. C. Bass, Tulane University, New Orleans, was awarded the medal for scientific research by the Southern Medical Association at its meeting in Richmond, November 12.

Dr. Caroline Hedger, of Chicago, will go to Rotterdam, Holland, and will take with her a sufficient quantity of anti-typhoid vaccin for 10,000 Belgian refugees in Holland, where typhoid has already appeared.

A new law in Philadelphia regarding the sale of meat from diseased animals permits the parts not affected to be subjected to a process of sterilization, cooking and canning and sold as "second-class meat, sterilized."

Dr. Walter H. Rowan, who has been for some time State Sanitary Inspector of Mississippi, has resigned and will become chief sanitary officer of Costa Rica. He will also be connected with the Rockefeller Foundation there.

At a meeting of the Pan-American Physicians, held in Cincinnati, October 28, Dr. C. A. L. Reed of Cincinnati was elected president; Dr. Ramon Guiteras of New York, secretary; and Dr. Henry L. E. Johnson of Washington, D. C., treasurer.

The United States Public Health Service is laying plans for the prevention of epidemics at the close of and during the European war. American consuls in Europe have been asked to report all epidemics and immigrants will be watched closely.

The Servian Government has sent out an appeal for qualified physicians and bacteriologists experienced in the treatment of epidemic diseases. Communications should be addressed to the

Secretary of the Servian Legation, 195 Queen's Gate, London, S. W.

Dr. W. E. Musgrave, Dean of the College of Medicine, University of the Philippines, has been made superintendent of the Philippine General Hospital, which has been reorganized and now conforms with the highest standards of the Association of American Medical Colleges.

The United States Government has selected the Georgia State Sanitarium at Milledgeville, Georgia, as a station for experimental pellagra work. The work will be in charge of two U. S. Public Health Service experts and the patients will be kept under strict observation and diet.

A new Blue Cross Society has been established in France. It is for the purpose of looking after and caring for the horses wounded on the battlefield. Many of these horses are only slightly wounded, but if left where they fell they would die slowly of their wounds, hunger and exposure.

A school of sanitary instruction will soon be opened by the Chicago Department of Health. All new employees of the department will be required to take a six months' course in the school and instruction will also be given students in medical schools of the city in public health work.

In an attempt to solve definitely the problem of ventilation, the New York State Commission on Ventilation, of which Dr. C. E. A. Winslow is chairman, is conducting experiments on sixty children. Two rooms of a new school are equipped with every kind of device for ventilating, including double floors, walls and ceilings.

The steamer "*Red Cross*" which took the American National Red Cross members to Europe, returned to New York on October 24, bringing back 150 refugees from Europe. Rear Admiral Aaron Ward, U. S. N., in charge, tells of the hospi-

talities of the Hollanders in consideration and appreciation of the work done by the American Red Cross Society.

The Federal quarantine against foot-and-mouth disease has been extended to Massachusetts, New York, Ohio, Pennsylvania, New Jersey, Rhode Island, Indiana, Illinois, Wisconsin, Delaware, Maryland and Michigan. Suspected human cases have been reported in Michigan, Ohio, Rhode Island and Indiana. The Rockefeller Institute for Medical Research is investigating the outbreak.

The Hamburg Red Cross has given what is said to be the most complete hospital train ever constructed. There are 29 cars for the transportation of the wounded, with 278 beds; a magazine car, baggage car, supply car, physicians' car, apothecary car, and a car for the hospital corps. The beds, which may also be used as stretchers, are fitted with spring mattresses, linen sheets and fresh blankets.

With fighting going on in Europe over such a large area and with so many countries involved, it is almost certain that all manner of epidemics will appear, many of them of tropical origin. On October 22, 98 cases of cholera were reported in Austria and 231 in Hungary. From Prussia are reported 617 cases of dysentery. Cholera has appeared in Kiev, Russia, and plague in Saloniki, Turkey, and in Lisbon, Portugal.

There have been a number of changes made recently in the College of Medicine and Surgery, University of the Philippines, Manila. Dr. P. G. Haughwout, of Columbia University, has been made special lecturer in the Graduate School of Tropical Medicine and Public Health. Dr. Ernest Linwood Walker has resigned as chief of the Biological Laboratory, Bureau of Science, and professor of Medical Zoology in the College of Medicine and Surgery, and the vacancy occasioned by his resignation has not been filled.

Surgeon R. H. von Ezdorf, U. S. P. H. S., has completed a malaria survey of Virginia. He has ascertained the breeding

places of the *Anopheles* mosquitoes and their eradication has already been started. The next step in the campaign will be the investigation of malaria carriers and then the educational work will be intensified. Dr. von Ezdorf, with Dr. M. Bruin Mitzmain and other members of the U. S. Public Health Service, is now stationed at the Marine Hospital in New Orleans, where the malaria investigations will be continued.

It is generally acknowledged that the painting of bullet wounds with iodine lessens the dangers from infection, but to be effective this must be done immediately and, therefore, must be done by the soldiers themselves, as they may not receive ambulance attention for hours and even days. The problem of carrying iodine has been solved by a French pharmacist who has put up the preparation in ampules of a convenient size in a small case, occupying about the space of a pencil. Baroness Henri de Rothschild has offered to give the army 200,000 of these ampules.

It is with deep regret that we note the death of Dr. Roger Post Ames, in Puerto Barrios, Guatemala. Dr. Ames was born in New Orleans and received his medical education at Tulane University. During the Spanish-American war he served as surgeon in the United States Army. About eight years ago Dr. Ames went to Guatemala, where he was first connected with the Government and later engaged in private practice. The death of Dr. Ames will be sincerely regretted by all workers in tropical diseases, and especially by the American Society of Tropical Medicine, of which he was a valued member.

Beginning on Sunday, November 29, the Minnesota Public Health Association held a Health Week. The first day was designated as Tuberculosis Sunday, and the church services were appropriate to the day. Monday was devoted to measles and Wednesday to whooping cough, when each child having had the disease was asked to wear a large "M" and "W," respectively. Those not having had the disease wore an "O." The water supplies were investigated on Tuesday, which was Typhoid Day.

Thursday was Children's Thursday, and Friday, Fly Day. The Public Health week closed on Saturday, Seal Day, when a special effort was made to sell Red Cross Christmas seals.

The eighth annual meeting of the Southern Medical Association was held in Richmond, Virginia, November 9 to 12. The following officers were elected: Dr. Oscar Dowling, Shreveport, La., president; Drs. Robinson C. Dorr, Batesville, Ark., and McGuire Newton, Richmond, Va., vice presidents; Dr. Allen W. Freeman, Richmond, Va., chairman; Dr. James A. Hayne, Columbia, S. C., vice chairman, and Dr. Waller S. Leathers, University, Miss., secretary of the section of public health. Dr. Joseph B. Greene, Asheville, N. C., chairman; Dr. Edward H. Cary, Dallas, Tex., vice chairman, and Dr. Thomas W. Moore, Huntington, W. Va., secretary of the section on eye, ear, nose and throat. Dr. Isidore Cohn, New Orleans, chairman; Dr. John H. Blackburn, Bowling Green, Ky., vice chairman, and Dr. Franklin Webb Griffith, Asheville, N. C., secretary of the section on surgery. Dr. William H. Deaderick, Hot Springs, Ark., chairman; Dr. Charles L. Minor, Asheville, N. C., vice chairman, and Dr. Stewart R. Roberts, Atlanta, Ga., secretary of the section on medicine. The next meeting will be in Dallas, Texas.

Public Health Activity.

INDIANA—Monthly Bulletin of the State Board of Health, September, 1914. "What's in a name" might well be said of a restaurant in a small Indiana town bearing the very magnificent name of "The Palace of Eats." Either through curiosity, excusable under the circumstances, or for some other reason, an inspector entered. Undoubtedly the "eats" were there, cakes, pies and buns in rows on the shelves, but the palace, so far as he could see, was sadly lacking. Flies swarmed everywhere, and through the open and unscreened back door could be seen an overflowing garbage can. The boy behind the counter had sore eyes, which he rubbed frequently, handling the sandwiches, cakes, etc., between times. But "The Palace of Eats" was doing a good business and the patrons seemed to give never a

thought to that which they did not want to see. And though bearing other names, places very similar may be found in almost every city or town large enough to support a restaurant.

NEW HAMPSHIRE—Quarterly Bulletin of the State Board of Health, July-October, 1914. Pellagra, considered always as a tropical or sub-tropical disease, seems to be working its way steadily north. Seven deaths from the disease are reported in New Hampshire in this bulletin and other cases are under treatment.

NORTH CAROLINA—The Health Bulletin, published by the State Board of Health, November, 1914. In this bulletin, as in a number of others, comment is made upon a recent ruling of the Kansas Supreme Court. The law states that any persons serving food that "makes their guests, boarders or employees sick" is liable for damages. The butchers, restaurant keepers and the others who serve or sell food whose freshness and purity are questionable may be persuaded by this law to provide better material in order to avoid possible prosecutions. If the law is enforced, after a few prosecutions the milkmen will see that they must furnish the public with clean milk, and numerous cases of typhoid will be avoided thereby.

OHIO—Monthly Bulletin of the State Board of Health, November, 1914. Under the title of "Medical Education in Hygiene and Public Health," Dr. E. F. McCampbell furnishes an interesting article on the necessity of special education in public health for all health officers. Frequently, especially in small towns where funds are scarce and the proper man unavailable, the one or ones entrusted with the duty of conserving the health of the community are but little better prepared for the office than are the people they are expected to educate. Dr. McCampbell is very strong in his opinion that every medical student, whether he intends to specialize in that line or not, should receive training in public health work during his medical school course and all those who have not received such courses should avail themselves of post-graduate courses before attempting to engage in public health work professionally.

OHIO—Weekly Report of the Cincinnati Board of Health, November 21, 1914. The 1913 general death rate in Cincinnati was 16.34 per 1,000. The white death rate was slightly under 16 per 1,000, while the colored was 33.40 per 1,000, or over 100 per cent more. Over four times as many colored persons die of tuberculosis as white; four and one-half as many die of the "Black Plague;" over twice as many die of alcoholism, two and one-half as many die of general paralysis of the insane; over twice as many die of diseases of the circulatory system; over three times as many die of pneumonia, and almost twice as many die of Bright's disease. Before the civil war their death rate was about equal to that of the white population, so that it is in conditions of modern times that the solution of the problem will probably be found.

CURRENT LITERATURE

SLEEPING SICKNESS IN THE LADO OF THE ANGLO-EGYPTIAN SUDAN. — Chalmers and O'Farrell (*Jour. Trop. Med.*, 1914, XVII, 273) make a report on some experimental work done in Khartoum upon material obtained by means of animals inoculated from cases of sleeping sickness at Yei in the Lado Enclave of Mongalla Province. They name the trypanosome obtained by these inoculations the Yei strain or Yei trypanosome. The patients were not brought to Khartoum for observation because of the danger of spreading the disease and of the desire not to hinder the treatment which drives trypanosomes from the peripheral blood and temporarily benefits the patients. The paper is concerned principally with the comparison of a strain of *Trypanosoma rhodesiense*, which was a lineal descendant of the original strain and brought alive from Liverpool in animals, and the Yei strain already mentioned. The African trypanosomiasis are due to *Trypanosoma gambiense* Dutton, 1902, *Trypanosoma castellani* Kruse, 1903, *Trypanosoma rhodesiense* Stephens and Fantham, 1910, and *Trypanosoma nigeriense* Scott-Macfie, 1913. Sleeping sickness is prevalent in the Belgian Congo and in Uganda, both of which districts join the Lado Enclave. The Yei strain has a minimum length of 18 microns and a maximum length of 36 microns. The minimum breadth is 1 micron and the maximum breadth 2.5 microns. The average length of 1,000 non-dividing trypanosomes is 25 microns. The posterior nuclear position has not been observed in this trypanosome. Its virulence for dogs, cats, rabbits, gerbils, jerboas, white rats and monkeys is distinctly less than that of *Trypanosoma rhodesiense*; but more marked than that of *Trypanosoma nigeriense*. In a dog the incubation period was 12 days; the average length of life was more than 40 days, often several months. In a monkey the incubation period was about 9 days; the average length of life was 35.5 days. In a gerbil the period of incubation was 7 days; the average length of life was 14.6

days. Immunity was produced in a dog; that is, the peripheral blood of the dog failed to show trypanosomes for more than sixty-one days after receiving its fifth inoculation with this strain. The last tested gerbil inoculated with this dog's blood failed to develop an infection. The serum of the dog, when fully immune, destroyed the trypanosoma from Yei in twenty minutes *in vitro*, but had no effect on *Trypanosoma rhodesiense* after one hour. When the serum of a partially immunized dog was mixed with trypanosomes and inoculated into a gerbil immediately after, the Yei trypanosomes produced an infection from which it was recovering thirty-nine days after inoculation when it died of heat stroke. *Trypanosoma rhodesiense*, on the other hand, produced an infection which killed the animal on the seventh day after inoculation. When the animal was completely immune 1 c. c. of serum was mixed with 0.1 c. c. of infected blood and after thirty minutes was inoculated into a gerbil. Under such circumstances the inoculation of Yei trypanosomes resulted in no infection being found in the peripheral blood. The animal thus inoculated was accidentally killed two days and fourteen hours after the inoculation. No trypanosomes were found in the internal organs, but peculiar bodies were seen in the cells of lung smears, comparable with the granules found by Archibald in the spleens of kala-azar patients and of animals inoculated with kala-azar. *Trypanosoma rhodesiense*, on the other hand, infected the gerbil and proved fatal in ten days. When brought in contact with normal human serum no trypanolysis took place with two strains of mule trypanosomes, *Trypanosoma rhodesiense* or with the Yei trypanosome. On the contrary, human serum appeared to have a beneficial action on the Yei strain. After one hour's contact the organisms were more active than at the commencement of the experiment. Strongly immune sera, on the other hand, destroyed the homologous trypanosomes in a most remarkable manner, but did not act on heterologous trypanosomes. Agglutination as a specific test is useless for the recognition of a trypanosome. As the result of this and other experiments, it is concluded that the Yei trypanosome is neither *Trypanosoma rhodesiense* nor *Trypanosoma nigeriense*. It is not dissimilar from the trypanosome

of the French Congo and is in all probability the same as the Uganda trypanosome.

It would appear to the authors as though sleeping sickness of Africa could be divided into the following categories: (1) southern sleeping sickness caused by *Trypanosoma rhodesiense* Stephens and Fantham, 1910, and spread by *Glossina morsitans* Westwood, 1850; (2) equatorial sleeping sickness caused by *Trypanosoma castellani* Kruse, 1903, and spread by *Glossina palpalis* (Robineau-Deavoidy, 1830); (3) northern sleeping sickness, which may be caused by *Trypanosoma gambiense* Dutton, 1902, and *Trypanosoma nigeriense* Scott-Macfie, 1913, and perhaps by some other trypanosomes as yet unknown. Their observations support the view that Sir David Bruce's method of measuring and charting a large number of trypanosomes, if carefully carried out, is of distinct value for the comparison of these parasites. The methods of differentiation by immunization and cross immunization as proposed by Laveran and Mesnil are of distinct value. It seems that the cases occurring in the Lado Enclave are sometimes chronic and at other times active. The former cases are found in the western part of this territory, while the latter are more numerous in the eastern part. The difference in chronicity may be explained by the fact that the disease has been endemic in the western portion for some time, while it has been newly introduced into the eastern part. On the other hand, there may be two different forms of sleeping sickness. The authors promise further investigation on these points. The paper contains a good map and numerous charts and tables.

John M. Swan.

A MODE OF PROPAGATION OF CHOLERA BY SEA.—(*Archiv. für Schiffs-und Tropen-Hygiene*, Heft 6, 1914.) W. T. Vogel points out the importance of the scuppers of a steamship in spreading cholera. When the lighters lie alongside the ship, the dirty, infected water from the scuppers can easily flow directly into the lighter or else splash on the guards. The workmen on the lighters can thus easily become infected. During the recent cholera epidemic in Java, the disease raged chiefly in the localities in which the harbor laborers resided. When cholera has

once gained an entrance into a port, it is much less likely to be carried by railroads than by ships. This was shown in the towns on the coast of Java to which no railroads led, and from which the disease could only have been spread by steamships. In the matter of treatment of cholera, Dubalen reports the successful use of adrenalin. Out of 166 cases so treated, only 43 died.

A. McShane.

NEOSALVARSAN AND OLARSOL IN THE TREATMENT OF RECURRENT FEVER OF NORTH AFRICA.—(*Bulletin Soc. Méd. Exotique*, No. 7, 1914.) H. Foley and C. Vialatte recently passed through an epidemic of North African recurrent fever in Beni-Ounif-de-Figuig, which was almost exclusively confined to the natives: Arabs, Berbers, or negroids. They saw patients in all stages of the disease and used neosalvarsan either in solution, intravenously, according to Ravant's technique, or in oily solution (olarsol), administered by intramuscular injections. The symptomatology of the disease is very uniform, two attacks being usually met with. The prognosis is always good: there was not a single death in 150 cases. The results of the treatment may be summarized thus:

We have observed that the end of one attack is not to be judged by the disappearance of spirilla from the blood, which is sometimes difficult to establish, but by an axillary temperature of 37° C., taken every two or three hours after the injection. The doses of neosalvarsan usually employed varied from $\frac{1}{2}$ to 1 centigram per kilogram of the body weight of the patient. (A patient weighing 132 pounds thus received from 11 to 22 grains at a dose.) These doses are notably smaller than those frequently employed, but they seem to be large enough to us. They have the advantage of not causing an excessive reaction, and it is better to use harmless doses in a disease in which the liver and kidneys are almost always involved. The perceptible differences in the rapidity of the spirillicide action of neosalvarsan is due more to the period of the disease in which it is given than to the size of the dose. As Levaditi has shown experimentally in studying the action of salvarsan in rats infected with tick fever, a cure is more rapidly brought about the more closely we ad

minister the drug to the crisis of the attack. Thus, it is best to give neosalvarsan in the pre-critical period, since smaller doses here suffice. In these conditions, neosalvarsan has always given us good results. It always prevents a recurrence; makes complications rare and shortens convalescence to a remarkable degree. Olarsol by intramuscular injections is always without effect in the same doses. It does not alter the course of an attack, and does not prevent relapses. *McS.*

EXPERIMENTAL RESEARCHES ON THE ETIOLOGY OF ENDEMIC GOITER (Third Series).—(*Indian Journal of Medical Research*, Vol. 2, No. 1, July, 1914.) In a large series of experiments the author, Robert McCarrison, continues the experimental production of goiter along lines suggested by his original observations in 1908, which have found confirmation by experimental procedures as well as analogy in the now fairly well understood similar disease in American trout. The original experiment consisted in the production of an enlargement of the thyroid in man by the consumption of large quantities of residue left on the candle of a Berkefeld filter through which a water credited with goiter producing properties had been filtered. It was also shown that enlargement of the gland did not follow when this residue was boiled.

The experiments here reported were performed on large numbers of tame and wild rats carefully controlled, with inoculated and non-inoculated animals under practically the same conditions. The glands in consideration were subjected to careful examination both macro and microscopically, with many photographs showing conclusively the characteristics of the various experimental phases. Tentatively the author concludes that at certain seasons of the year goitrogenous substances may be present in the feces of both goitrous and non-goitrous persons and animals which are capable of causing the development of massive goiters in infected rats, enlargement of the gland not being found in the controls, and over which neither nutritional factors nor insect transmitters of disease form a responsible factor. The excreta of the human or animal subject seems to be the main source of the

disease; and with which house, room, cage or fish-tank infection follows. The infecting agent is capable of life, and probably some degree of growth outside of the body, in fecally contaminated soil or grossly polluted water; and suspicion points to some of the intestinal anaërobes as possessing a goitrogenous influence on the thyroid gland. Water, food, soil or other media whereby the infecting agent or agents of the disease reach the bodies of man and animals are of importance only as vehicles of its transmission.

F. M. Johns.

THE RELATION OF METHODS OF DISPOSAL OF SEWAGE TO THE SPREAD OF PELLAGRA.—(*Archives of Internal Medicine*, Vol. XIV, No. 4, October, 1914.) J. F. Siler, P. E. Garrison and W. J. MacNeal report what would seem to be very important observations on methods of disposal of human waste and their relation to the incidence of pellagra in Spartanburg County, where the work of the Thompson-McFadden Pellagra Commission has been concentrated. In the rural communities the incidence rate was 16 per ten thousand population; in the city of Spartanburg, exclusive of mill village sections, it was 29 per ten thousand, and in the mill village communities of the county it was 104 per ten thousand. In 243 cases of pellagra investigated in 1912, the methods of disposal were: 5% modern water carriage system; 20% wooden outhouses, metal receptacles; 60% unscreened open wooden privy, no receptacle; 12% no privy at all. Siler, Garrison and MacNeal were able to find two mill villages in other counties in which a modern water carriage system had been in use for more than one year. There occurred only one case of pellagra in which there was not definite evidence that it originated elsewhere. On the other hand, there occurred many cases, 104 per ten thousand in the mill villages, which did not have a water carriage system, many of which certainly originated while the person resided in the village.

In the city of Spartanburg there was a distinct tendency for the disease to be confined to the parts of the city where the unscreened surface privy was in use. Prophylaxis of pellagra is now being tested practically by the Commission along lines suggested by these observations.

C. C. Bass.

SYSTEMATIZED EDUCATION OF THE PUBLIC IN HEALTH MATTERS.—(*New York Medical Journal*, September 12, 1914.) Horace Greely makes a plea for the betterment of public instruction in sanitary matters and hygiene along lines which, if carried out, would prevent the communication and spread of venereal and other diseases. He intimates that instruction of public school children in the first principles of anatomy and hygiene, including parasitology and physiology, would in the latter years of the grammar school education be practicable and later bear excellent fruit. Unfortunately the attitude of the general public, surrounded as it is by the obstacles of "suppositious morality" and religious scruples, is to a great extent unfavorably inclined. The public prefers to remain in ignorance of the facts regarding the widespread scourges of gonorrhœa and syphilis rather than allow the younger generation to be instructed in the fundamental principles of prophylaxis. The results of this neglect are seen every day in private practice and the hospitals, not to mention the possible innocent victims among the unborn. The propaganda of newspapers, societies, committees and philanthropic organizations, while ardent enough at the start, soon lose interest, and the agitation eventually dies out. The interest and coöperation of all must be aroused and sustained if anything definite in the eradication of disease is to be accomplished, and this must be brought about by public instruction. The author suggests that instruction as well as a "health catechism" in schools, the spreading of pamphlets, and the more direct and continuous assistance by way of the newspapers offers a solution to this most difficult and urgent problem.

L. C. Scott.

SPOROTRICHOSIS IN THE MISSISSIPPI BASIN.—(*Jour. of the A. M. A.*, Vol. LXIII, No. 14). R. L. Sutton gives an outline of the history, symptomatology and course of five cases which came to his notice. They all presented an initial lesion with successive nodules along the lymph channels in due course. These broke down with the formation of shallow ulcers which with the most rigid antisepsis refused to heal. All cases occurred on the upper extremity, either on the hand or forearm,

and in three cases with history of trauma. All healed satisfactorily and though potassium iodid was used in three, it is not mentioned in the fourth or fifth. It is supposed to be a fairly frequent disease in the Middle West. Diagnosis by culture is often impossible after a cleansing of the ulcers with antiseptics.

L. C. S.

PELLAGRA IN MINNESOTA.—(*Jour. of the A. M. A.*, Vol. LXIII, No. 14.) (D. R. Brengle.) Four cases of pellagra have been observed in Minnesota which ended fatally after a duration of from two to three years. Three cases were women and one a man. The author gives a further account of a typical pellagra case in a Cuban admitted to the hospital with all the typical symptoms of the disease. The only noteworthy point seems to be the association with a pellagrin. The patient improved both mentally and physically on diet and Fowler's solution treatment.

L. C. S.

TREATMENT OF PELLAGRA.—(*Jour. of the A. M. A.*, Vol. LXIII, No. 13.) Carl Voegtlin considers the prevalent methods of combating the diarrheic symptoms with oils and points out their nutritive effects. He further reviews the extensive usage of arsenic and points out that Lombroso considered it an almost specific remedy together with salt. This the author thinks of little value the arsenic playing the part of a stimulant to metabolism or alterative. Diet is probably the best hope as a remedial agent together with change of environment which under circumstances has affected apparent cures. Finally, the author discusses the part that vitamins may possibly play as a factor in the etiology, especially where foods of a certain and perhaps inferior sort are consumed over an extended period of time.

L. C. S.

CEREBELLAR DYSERGIA FROM MALARIAL THROMBOSIS WITH REMARKS ON THE CLINICAL FORMS AND PATHOLOGY OF PERNICIOUS MALARIA AFFECTING THE NERVOUS SYSTEM.—(T. B. Williams, *Southern Medical Journal*, October, 1914, Vol. VII, No. 10.) A case which shows a history of pernicious malaria is described. The patient, a man of 38 and employed in a business which re-

quires considerable application of the function of coördination, has for some length of time been hampered in his work by ataxia. Cerebral manifestations are normal, there are no signs of syphilis, the cerebro-spinal and Wassermann tests are negative. The Romberg is positive both with closed and with open eyes. Diadocokinesis is impaired. Sensibility fairly intact. Pupils react though slightly. No malarial parasites were found. Disturbance seemed to lie in the cerebellum. It was necessary to exclude multiple sclerosis by the absence of nystagmus and plantar extension. Tabes could be excluded by negative Wassermann and intact sensibility. It is assumed that the cause of the disturbance is due to blocking of cerebellar capillaries with malarial parasites, with subsequent interruption of cerebellar strands.

L. C. S.

EXPERIMENTS WITH NEW TROPICAL DRY LYMPH PREPARED BY PONNDORF-WEIMAR.—(*Archiv. für Schiffs-und Tropen-Hygiene*, Bd. 18, 1914, Heft 16.) H. E. Kersten remarks about the difficulty of getting lymph from other countries and the ready loss of activity on being kept in tropical countries, that used up to the present being obtained from Sydney. The samples of dried lymph with which he experimented were obtained from Dr. Ponndorf, director of the Grand Ducal Lymph Institute at Weimar. The method of preparation is not given, but he is assured results in Weimar were effective in 100% of vaccinations. Directions for keeping and preparing the lymph as well as dilution and manner of vaccination are given. The dry lymph is contained in ampules as a fine brown powder. Included in the package are glycerin 50% and a file.

The individuals were vaccinated on the right arm with the experimental lymph and on the left with glycerine lymph, obtained from Sydney preserved on ice, whose virulence had been determined before.

The results obtained are summed up in the conclusion that the Ponndorf dry lymph exceeds the Sydney lymph in keeping qualities even without ice conservation, and that its virulence is at least equal to the Sydney lymph.

L. C. S.

THE ETIOLOGY OF DYSENTERY IN SOUTH KAMERUN.—(*Archiv für Schiffs-und Tropen Hygiene*, Bd. 18, 1914, No. 16.) (By Government Physician, Dr. Hallenberger.) The object of the author's investigation is to throw as much light as possible on the etiology of the numerous cases of dysentery in Kamerun which up to the present time have received but slight attention in the medical literature. After a review of the literature existing on the subject, the author gives a list of his own investigations. The most of the sixty-two out of seventy-one cases investigated had received their infection in the low-lying coast lands; some, however, from the central forested portion of the country. The results give 89% bacillary and 6.5% amebic dysentery. Over half of the bacillary cases came from the coast.

The author's procedure was to investigate the stools as soon as the case arrived and before a cathartic or dysentery remedy had been given. He detected the *Ameba tetragena* in every amebic or mixed case without difficulty. The agglutination reaction, Shiga-Kruse and Flexner bacilli, were tried in every case where the ameba were found. Every stool was investigated for bacilli, whether ameba were found or not, before any medication had been given and immediately after a passage. In every case where bacillary dysentery was suspected the author was able to isolate a strain. This was done by washing fecal masses in sterile salt solution and then drawing over the surface of Drigalski-agar plates to which no krystal violet had been added. Next day the blue colonies were transferred to other Dragalski-agar plates and upon the appearance of the suspicious colonies these again transferred to pure cultures. The pure cultures were confirmed by agglutination reaction with the patient's own serum.

The differentiation of the various types was carried out by means of culture media containing the sugars recommended by Lentz. The author gives a table in which the reactions on mannite, maltose, saccharose and grape sugar are given. Indol tests were also made. The main means of differentiation of the two groups was the characteristic attitudes of the Flexner and Shiga-Kruse bacilli to mannite. The types, of which there are three

in the Shiga-Kruse group and two in the Flexner group, were distinguished by changes in the other media.

Agglutination tests were carried out with serum agglutinating 1:2000 received from Germany and with serum from the patient himself. These were made in dilutions from 1:10 to 1:2000. A table is given of the agglutination tests which distinguishes the two groups satisfactorily, especially in the stronger dilution. A discussion of the results follows.

In conclusion the author has a few words to say regarding the pathogenicity. According to Lentz, the bacilli of dysentery can be divided into two principal groups: those producing considerable toxin, to which the Shiga-Kruse bacillus belongs, and the Flexner group, producing less toxin. The author had the opportunity of observing cases in which this relation was changed. In one case which came to autopsy, the ileum, rectum and colon were affected, the walls being as much as 1 cm. thick in some places and the mucose covered by a thick diphtheritic membrane. The name of "pseudodysentery" does not seem applicable since relatively slight toxic Flexner bacillus can and did in this case produce a severe form of dysentery. In summing up the results of his observations the author finds that both amebic and bacillary forms of dysentery are endemic in Kamerun, in proportion 1:14. The *Ameba tetragena* and the bacilli of Shiga-Kruse and Flexner are the causes, both of which types can produce a genuine dysentery. L. C. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

BOOKS.

MANSON. Tropical Diseases. Fifth Edition. Wm. Wood & Co., New York.

REPRINTS.

CASTELLANI, ALDO. *Tinea Imbricata* (Tokelau). Reprinted from the *British Journal of Dermatology*, December, 1913.

CASTELLANI, ALDO. The Plurality of Species of the So-called "Thrush-Fungus" of Temperate Climates. Reprinted from the *Journal of the Ceylon Branch of the British Medical Association*, June, 1914.

CASTELLANI, ALDO. Typhoid-Paratyphoid Vaccination with Mixed Vaccines. Reprinted from the *Indian Medical Gazette*, Vol. XLVIII, No. 12, December, 1913.

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CASTELLANI, ALDO. Note on an Intestinal Protozoal Parasite Producing Dysenteric Symptoms in Man. Reprinted from the *Journal of Tropical Medicine and Hygiene*, March 2, 1914.

CASTELLANI, ALDO. Note on Certain Protozoalike Bodies in a Case of Protracted Fever with Splenomegaly. Reprinted from the *Journal of Tropical Medicine and Hygiene*, April 15, 1914.

CASTELLANI, ALDO. Notes on the Hyphomycetes Found in Sprue with Remarks on the Classification of Fungi of the Genus "Monilia." Reprinted from the *Journal of the Ceylon Branch of the British Medical Association*, June, 1914.

PLATE, LUDWIG. Brief Note on *Toxoplasma Pyrogenes* (Castellani, 1913). *Ibid.*

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EDITORIAL

The Dentist in Preventive Medicine.—Since dentistry was divorced from medicine and became an independent vocational occupation, the mechanical side has very much obscured the former medical aspects of this calling.

Some of us recall the time when the dentist was often at first a physician who afterwards specialized in dentistry. University Colleges of Medicine still offer degrees in dentistry, and during the course of the dental student there is a strong influence laid from the School of Medicine, but more especially in fundamental sciences, as chemistry, anatomy and physiology. Pathology and bacteriology are burdensome to the average dental student and he seldom develops any pathological point of view, until long after he graduates. So it is that the problems in human pathology related to the teeth have, for its most part,

come to the medical man in his laboratory, and not to the dentist, who should be most interested.

We have already learned the direct relation of dental caries to diseased conditions remote from the mouth, even hemorrhagic infective results occurring. Eye strain, or pain, has been found related, and even baldness has been attributed to bad teeth.

Now that Rigg's disease has been studied by Smith and Barrett and by Bass and Johns, and an ameba found (*E. buccalis*) which is probably the occasion of *Pyorrhea alveolaris*, we may understand the dentists' confusion in attributing the disease to rheumatism, when probably the disease and its accompanying cocci infections are responsible for the rheumatism, instead.

The teeth of children are usually neglected, but the rapid development in school hygiene has not overlooked the inspection of the teeth, and the early care of such may ensue.

The dentist has really a large place in preventive medicine, and here and there we are finding him ready to take part in modern scientific progress in these lines; but he needs some training in pathology and in bacteriology to give him a proper breadth of view in the matter.

All sorts of opportunity open up for research in the dental field, and the food problems may have much bearing.

The academic side of dentistry has been submerged for fully a quarter of a century, and the signs of awakening point to a possible usefulness outside of the mere mechanics of the calling.

D.

ORIGINAL ARTICLES

THE OCCURRENCE OF YAWS IN THE UNITED STATES.

By

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Yaws is a tropical disease occurring chiefly among people of African blood. It is characterized by an eruption assuming the character of a granuloma and is infectious by direct contact through any abrasion of the skin. In many respects it resembles syphilis, with which it has been confused until quite recently, and, like syphilis, it is due to a spirochæte, the *Treponema pertenue*, which is only distinguished from the *Treponema pallidum* with difficulty.

In 1844, John Hume of Edinburgh brought forth the view that yaws was definitely referred to in the thirteenth chapter of Leviticus. There is argument for and against this theory, though it must be admitted that the disease known in the Bible as leprosy must have included more than is understood by that term to-day. Like many other diseases it has undergone more definite classification, and the term of that period probably includes half a dozen diseases of to-day.

It is claimed that yaws was not brought to the attention of Europeans until after the discovery of America, though its existence for many centuries before this in Africa is not seriously questioned. It is contended by some that it has occurred in many parts of the world not reached by the African slave trade.

An epidemic of syphilis is supposed to have originated in the armies before Naples in 1493, and to have spread widely through Europe. Some writers have thought that this was yaws which had been brought to Italy by Spanish soldiers returning from America. This is probably erroneous because these bold adventurers hardly reached Europe before 1495. The view has been advanced that this outbreak was really syphilis, which was brought into Europe by the Moors who settled in Spain.

Rat has shown that yaws was not alone peculiar to Africa, as its prevalence is mentioned by several French writers (Ray-

mond Breton, Rocheford, Labat), occurring along the Mississippi river among the Indians, especially the tribe of Caribs.

Probably the first authentic reference to yaws in American literature is to be found in that quaint old volume entitled: *The Natural History of North Carolina with an Account of the Trades, Manners and Customs of the Christian and Indian Inhabitants*. Illustrated with Copper Plates, Whereon are curiously Engraved the Map of the Country, several strange Beasts, Birds, Fishes, Snakes, Insects, Trees, Plants, &c. By John Brickell, M. D., Dublin, 1737. While the present-day idea of yaws differs somewhat from this description, still there is much about the following account to indicate that there was no error in the diagnosis:

“The Yaws are a Disorder not well known in Europe but very common and familiar here; It is like the Lues venera having most of the Symptoms that attend the Pox, such as nocturnal Pains, Botches, foul Eruptions, and Ulcers in several parts of the Body, and is acquired after the same manner as the Pox is, viz., by Copulation, &c., but is never attended with a Gonorrhœa in the beginning. This Distemper was brought hither by the Negroes from Guinea, where it is a common distemper among them, and is communicated to several of the Europeans or Christians by their cohabiting with the Blacks, by which means it is hereditary in many Families in Carolina, and by it some have lost their Palates and Noses.

“This Distemper, though of a venereal kind, is seldom cured by Mercurials, as I have often experienced, for I have known some to undergo the Course of three Salivations to no purpose, the virulency continuing as bad as ever: Wherefore I judge it not amiss to set forth the most effectual method for curing it, which I have often experienc’d and never without good success (during my residence in those parts) though the Distemper was of ever so violent a nature, or long continuance”

It is usually conceded that the term frambœsia owes its origin to Sauvages, who described the disease in 1757. It came from the French word *framboise*, meaning raspberry, and was merely the translation into French of the term given by the West Indian natives. The term yaws is said to mean strawberry, but there can be little doubt that the two terms are synonymous, one merely being a translation into a written language. It will be noted that a comparison of the dates of Brickell’s writing (1737) and Sauvages’ (1757) gives the former the priority, but it is noteworthy that Brickell certainly did not coin the word,

but was merely repeating an expression common among the people of the West Indies. West Indian yaws in all probability has existed since soon after the Columbian period, and was brought to that section through African slave trade, though this is not readily proven.

Allbutt records the following synonyms: In the French Antilles, pian; in the Brazils, boba; on the west coast of Africa, gatta, dube and tangara; in the Moluccas, bouton d'amboine; in Fiji, koko; in New Caledonia and the Samoan Islands, tonga or tono; in Ceylon, parangi.

The records of yaws in the literature are so few that an effort will now be made to briefly mention every case reported in the United States. It is likely that some cases will be inadvertently overlooked. In this work I have been aided greatly by Professor Isadore Dyer of Tulane University.

In 1832, Dr. Charles A. van Zandt reported in the *New York Medico-Chirurgical Bulletin* the case of a negro man cook on board a vessel from the West Indies. The victim had slept in the same bed which had been used by a victim of yaws and even at that early date the contagiousness was well recognized.

In 1847, Dr. R. W. Evans reported in *The British-American Journal of Medical and Surgical Science*, published in Montreal, the case of an Irishman, aged twenty years, and the diagnosis was unquestionable. This observer had had the advantage of seeing yaws in East Florida in two instances. Both of these cases were negroes and it is probable that the disease could be traced to the West Indies.

In 1858, Dr. Greenville McDowell of Columbia, Tex., reported in *The New Orleans Medical and Surgical Journal* the case of a negro child, aged two years, with an ulcerating fungoid growth about the anus. The mother had yaws. He claimed that yaws was an African name.

In 1878, Dr. Joseph Jones wrote an article for *The New Orleans Medical and Surgical Journal* under the title, "Observations on the African Yaws." On Oct. 27, 1877, he presented to the New Orleans Medical and Surgical Association a case of yaws in one Augustin Faine, a native of the Isle of Bourbon, off the coast of Africa. In 1887, this same writer contributed

to the Medical and Surgical Memoirs an article entitled, "The History of the African Yaws in America."

In 1896, a case of yaws was reported by Dr. Rudolph Matas in Dennis' System of Surgery. The patient was a negro who had not been out of the state of Louisiana. The case occurred in the service of Dr. M. S. Souchon in the Charity Hospital, and was diagnosed by Dr. Isadore Dyer.

In 1895, Dr. A. J. McCosh presented to the New York Surgical Society a case which was diagnosed by him as yaws. The patient was an unmarried woman of twenty years who had had syphilis prior to yaws. The latter disease made its first appearance as a pimple just below the nasal septum and spread to the septum. At the time of presentation there was a papillomatous excrescence on the tip of the nose looking "like a large raspberry." He thought the basis of such a growth was usually a syphilitic origin. This article was published in the *Annals of Surgery* for 1895.

In the *Virginia Medical Semi-Monthly* for Feb. 9, 1900, there appears an article by Dr. R. L. McMurran under the title, "Yaws and Smallpox." He claimed that much of the so-called smallpox was really yaws in his section of Virginia:

"February 17, 1899. Miss G. Y. Age, 24 years. She had had a chill on the night before and complained of pains in her back. After examination I found no inflammatory process of the mucous membranes of the throat and mouth; her temperature was 101° F., pulse 100, respiration 20, bowels constipated. I ordered a saline purgative and a little phenacetine and salol to be given her. The next morning her temperature was 100°; other symptoms the same. On the morning of the fifth day I noticed some vesicular eruption on her forehead, hands, and slightly on her breast. Upon examination during this visit I found her temperature normal as well as the respiration and pulse. I still found no eruption on the mucous membranes of the mouth or throat. Her condition continued to improve with no impairment of general health. The tubercles peeled off and I did not observe any pitting afterwards on her face. Neither this patient nor L. P. (smallpox) had ever been vaccinated. The symptoms of this case were entirely dissimilar from those of L. P. and resembled yaws."

In the Proceedings of the Philadelphia Pathologic Society (N. S.), Volume 14, 1911, Captain Henry J. Nichols of the United States Army Corps contributes a most valuable report on yaws. In recent years no man except Castellani has done

as much as Dr. Nichols to advance our knowledge of this disease. In this article he points the fact of the auto-inoculability of the disease in man, and says it is in line with the incomplete immunity seen in many protozoal diseases. This article will be referred to later. He makes a very significant statement: "The skin lesions of yaws are always the same, and consist of raspberry-like growths covered with a yellow crust of dried serum."

At a meeting of the New York Surgical Society held on November 8, 1911 (*Annals of Surgery*, Vol. LX), Dr. Henry H. M. Lyle presented a patient from Grenada, forty-nine years old, who gave a history of yaws. There was no history of syphilis. For symptoms of an indefinite character an exploratory laparotomy was done and a smooth, round tumor about the size of a mandarin orange was found on the anterior surface of the left lobe of the liver, which was proven to be a gumma. The writer says that the interest in the case rested in the possible relationship of yaws and syphilis.

The following case is important for the reason that the child was born in North Carolina of parents who had always lived in that state and at no time had there been a contact with any one from the West Indies or other section where yaws is known to occur. It will be recalled that it is quite unusual for yaws to attack any except of the African race in the Western Hemisphere, at least. Had this patient been a negro the diagnosis of yaws would have been accepted much more readily:

C. M. Age, 5 months. White. Seen on November 11, 1909. He was a fairly well conditioned but neglected child. His father was a man of good habits but a frail neurotic. His mother was a huge, sour-tempered, ignorant woman, but physically she was sound. Neither parent had any history or trace of syphilis.

The child was born at term and weighed 10¼ pounds. He was breast fed throughout. Colic occurred every afternoon from birth. The stump of the umbilical cord did not heal completely until the eighth week. When he was seven weeks old I treated him for a definite malaria.

When he was ten weeks old there appeared on the back of the neck an eruption described as "red with little blisters thought to be heat." This eruption later appeared on the head and feet. There was some fever from the beginning. The lesions began as macules, then became papules, and later vesicles, pustules and crust formation followed. The lesions stood

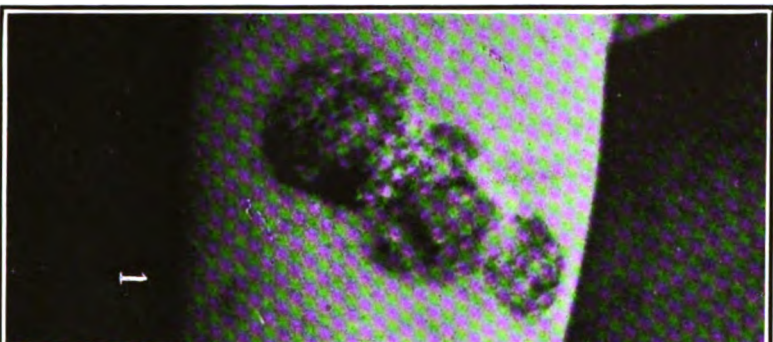
off from the skin surface like variola, tended to coalesce and were auto-inoculable. There was some itching. It was noticed that there was a definite tendency for the lesions to appear in crops and the one under our observation was the third. Situated on the scalp were lesions varying in size from that of a pin head to a five-cent piece and they were made up of papules, deep-seated vesicles, pustules and crusts. When the crusts were lifted up there was no flow of pus but a definite tumefaction remained which stood up above the skin surface and was quite distinctive in appearance. The larger lesions resulted from coalescence of the smaller ones. In many instances the larger lesions were from one-eighth to one-quarter of an inch above the skin surface. On the right cheek was a large, irregularly shaped papulo-vesicular-pustular lesion. On the external surface of the right forearm was a lesion one inch by three-quarters of an inch in size which was made up of crusted lesions resulting from auto-inoculation. The first of these to appear was an elevated brown tumefaction which was thought on first sight to be a rupia. There was no pus in this lesion though it was decidedly elevated. The lesions appeared on the palms and soles. There was a dactylitis with the loss of a finger nail from the right hand and the loss of three nails from each foot. On one finger of the right hand was found a papulo-pustular lesion about the size of a split pea. As a rule there was no inflammatory areola in any of these instances.

The liver was much enlarged, the lower border reaching to about the crest of the ilium. The spleen, likewise, was considerably enlarged, extending almost to the mid-line of the abdomen. There was no glandular enlargement. There was a rise of temperature every night (101.4 to 103). Great restlessness was the most troublesome symptom. In spite of the disease, however, the child remained fairly well nourished. Both clinically and therapeutically malaria was excluded.

Mercury in the form of the salicylate was given hypodermically without any effect.

In March, 1914, the child was again seen after an interval of four years. He was found to be a vigorous boy with only a scar on the forearm to indicate the past trouble. The mother informed me that all the children in the house had had the disease in milder form. She, herself, had also had a trivial outbreak. Her own account of the lesion was that after the crusts came off there was left the typical appearance which is so aptly compared to the surface of a raspberry. This child was said to have been placed on a bed with another infant who was suffering from the same condition and the mother attributes this exposure as the source of the disease in her first child.

At this same time my colleague, Dr. R. H. Bellamy, who saw my case, had under his care another white case which was identical.



1. Typical Yaws Lesion.



2. Figure two, writer's case.
ILLUSTRATING PAPER OF DR. E. J. WOOD



3. Figure three, writer's case

At the time of this observation every effort was made to arrive at a reasonable diagnosis, but without success. More recently, in the light of the research of such men as Captain Nichols and others in their study of the action of Ehrlich's salvarsan and its effect on the spirochæte group, attention has been attracted to yaws as a possibility in this country. It was then that I looked up my notes and photographs of this case and made a tentative diagnosis of yaws. Not being willing to accept such an important solution of the question I submitted the notes and photographs to Professor Isadore Dyer of New Orleans. From his letter I quote as follows:

"First, let me take up the photographs. It would be difficult to make a diagnosis of yaws from the lesions on the head of the child; those on the arm are more suggestive of yaws.

"To me, the differential diagnosis in your case, from the photographs, would have to be made among bromide eruption, a vegetating syphilide, yaws, and blastomycosis. The syphilis can be ruled out on the evident fungoid character of the lesions growing so well above the skin. The same would apply to the bromide eruptions, particularly if you know bromide was not given. Blastomycosis is practically unknown in infants, and, moreover, assumes a very much more formidable character than the smaller lesions in your case would suggest.

"This leaves yaws by exclusion."

Since studying the condition more fully I am inclined to suspect that we have been overlooking yaws and that among negroes the disease has occurred in the South frequently and has been counted as syphilis. A case is recalled in this connection of a prominent negro who wished quick relief in order that his immoral disease might not interfere with his Sunday school duties. It was a circinate eruption which failed to respond to salicylate of mercury treatment, though given hypodermically in full dosage. Looking back in the light of present information on the subject this was likely a case of yaws and there are probably others of the same nature which are really not syphilitic. This is more readily appreciated when it is recalled how the medical profession view the problem of the negro and syphilis. Every negro is assumed by most observers to be guilty of syphilis until he proves his innocence, which is rarely indeed believed, recalling to our mind Ricord's sarcastic utterance in this regard. Can it be that syphilis is being generally confounded with yaws

in this manner and can it explain the well-recognized mildness of present-day syphilis among the negro? Surely we see comparatively few cases of tertiary manifestations among the negro in comparison to that seen in the white man.

In the absence of a consideration of yaws in the American textbooks of medicine it may not be amiss to enter here into a general account of the disease.

Any study of the literature of yaws prior to 1905 is superfluous except from the academic standpoint. Chief among those who claimed specific organisms should be mentioned Pariez, who found a number of micrococci; in 1896, Powell attributed it to a yeast; in 1899, Nicholls and Watts isolated a coccus which, however, did not satisfy the postulates of Koch. In 1905, Castellani found a treponema, or spirillum, which he named *Treponema pertenue*. This discovery was counted a direct sequel of Schaudinn's work. Both Schaudinn and Castellani considered this organism and that of syphilis to be morphologically identical at that time. Later minute differences in form were pointed out by Prowazek and Russell.

As early as 1848, Paulet inoculated fourteen negroes with secretions from yaws' granulomata, and in every case the disease resulted. The period between the inoculation and the development of the disease varied from twelve to twenty days. In ten cases the first nodule appeared at the seat of inoculation, and in two cases the first lesion appeared at some other part of the body.

In 1881, Charlotius inoculated thirty-two Chinese prisoners with crusts and scrapings from yaws' lesions, and in twenty-eight instances succeeded in producing characteristic yaws. He also succeeded in inoculating a native suffering with yaws with syphilis, thereby successfully disproving the fact that the two were really one and the same. Since that time the evidence has gradually grown which proves the fact that the two are distinct diseases. It is further a matter of established fact that a syphilitic may contract yaws in the usual manner as well as experimentally.

The fact that monkeys are susceptible to yaws infection has greatly aided in the experimental work which has resulted

in such brilliant achievement. Chief among these workers should be mentioned Castellani in Ceylon, Neisser, Prowazek, Halberstaedeer in Java. In monkeys the lesions occurs at the point of inoculation and the spirochæte may be found in the spleen and also in the lymphatics. It is said that splenic blood from a yaws' victim will cause the disease in monkeys. It has been shown that monkeys inoculated with yaws are not immune to syphilis.

Immunity experiments on man and laboratory animals form the basis for a differentiation between the spirochæte of yaws and syphilis. Morphologically such a differentiation could not be made with any great degree of accuracy. H. J. Nichols has pointed out the fact that the recent advance in the study of syphilis by Parodi, Uhlenhuth and Mulzer marks a very decided step forward in the differentiation of these two closely related diseases. These observers demonstrated that a syphiloma in the testicle of the rabbit could be produced by inoculation. Nichols observed a series of infections of yaws and syphilis running parallel in the same animal.

The spirochæte of yaws has been transferred from man to monkey through three generations in the rabbit. Eight out of sixteen of Nichols' rabbits were infected. The incubation period varied from forty-one days in the first instance to twenty-four in the third. The spirochæte is readily stained by the Giemsa method and its detection is greatly aided by the dark field microscope.

H. J. Nichols says that

"The difference in the lesion of syphilis and yaws in the monkey seems to be the surest way to differentiate the organisms. In yaws the incubation period is two to three weeks, the lesion is elevated, slightly scaly, and very edematous; in syphilis the incubation period is about four weeks, the lesion is flat, dry and very scaly. According to Prowazek and Russell, *Treponema pertenuis* is slightly thicker than *Treponema pallidum*, less rigid, less regular in its twists. With an abundance of material at hand, comparative observations have been made with the dark field microscope. *Treponema pallidum* seems quite constantly to show more active corkscrew motion; the twists seem more regular and not so sharp and deep; but occasionally an unknown specimen has been classified wrongly on these points and no other differences seem more reliable. The lesion in the rabbit seems to differ only in degree; the nodules in syphilis seem larger and have a

neerotic centre; histologically, there is evidence of a more active inflammation."

In the yaws nodule there is found an absence of the giant cell so characteristic of syphilis. According to MacLeod there is also wanting the perivascular mononuclear infiltration so much a part of the pathology of syphilis. Yaws also differs from syphilis in affecting the epithelium rather than the cutis. As a rule there is more edema in yaws than in the syphilitic lesion.

Castellani and Chalmers point out that in yaws the papules show a considerable increase in the surface epithelium with numerous down growth, and there are many patches in which the epithelial cells are swollen and vacuolated. In addition they notice sharply circumscribed areas containing detritus and polymorphonuclear leucocytes. Near the corium and its processes the layers are almost normal in appearance. They noted that the connective tissue corium forms a thin layer from which narrow, elongated, papillary processes pass into the epithelium and some of them almost reach the surface. There is decided edema of the corium and a diffuse cellular infiltration which is made up of large and small mononuclears, plasma cells, eosinophiles, polynuclears, connective tissue cells and extravasated red blood cells. In the lesions of longer standing the plasma cells largely predominate. Hyperkeratosis develops after the existence of the yaws granuloma for a considerable time. Castellani has shown the presence of large numbers of polychromatic red blood cells of different sizes in the films taken from the granulomata. The treponemata may be detected by the use of such staining methods as the silver stain of Levaditi.

The symptoms of yaws very unfortunately are divided usually by the writers into three stages, primary, secondary and tertiary. This is, of course, a remnant of the old view that has not been generally abandoned, which made of yaws an evolutionary product of syphilis. The division is purely arbitrary and should be abandoned. Three stages will be given as the textbooks have them, but with this apology.

The primary stage is the initial lesion which usually develops in from two to four weeks after the inoculation. This lesion is usually but not necessarily extragenital. The lesion

is a papule which pustulates and in the end is covered with a crust. It may be composed of several coalesced papules covered by a common crust. Beneath the crust is found an ulcer with sharp edges. This ulcer heals with a white scar or it forms a granuloma which is much similar to the characteristic yaws lesion which predominates the secondary stage. Sometimes the lesion is much larger than the ones which follow, and is known as the "mother yaw." This is well illustrated in the lesion of the child's arm shown in Figure I. There is no induration in this lesion. The proximal lymphatics sometimes become enlarged but do not suppurate. The primary lesion exists in many instances for months, even after the development of the secondary lesions, as is shown in the illustration herewith presented of the writer's case. The mammae are frequently the location of this initial lesion. Again, it is frequently found in the crevices and abrasions of the skin of the feet, and owes its origin to the bites of insects which easily find access because of the custom of going bare-footed, which is so prevalent among the negroes of the warmer climates.

The time of the appearance of the secondary lesions varies from one to three months from the time of the first notice of the primary lesion. It will be noted that there is a certain indefiniteness about the periods in yaws which is quite different from the rule in syphilis.

The constitutional symptoms of yaws are by no means so definite as in syphilis. These constitutional symptoms usually appear with the general eruption. The patient has headache, malaise, general aching and a little fever, though he will not be sick enough to give up work. The skin lesion begins as minute round papules which acquire a yellow apex. These remain the same size throughout and disappear without further change. Others increase in size and coalesce. This coalescence results in the characteristic granuloma which is nodular and papules vary in size from a pinhead to a small grapeseed. Some covered with crusts. When the crust is removed there remains a raw surface with fungoid granulations secreting a slightly purulent discharge, which dries into a crust. It was this irregular surface from which projects little protuberances which

gave rise to the comparison of a raspberry from which the name of the disease is derived. Some writers think this name far-fetched and that the name has another significance. The location of the secondary lesion is chiefly the extremities, about the anus, the face, and over the region of the chest. The scalp is rarely affected, though we see an exception in the case presented and certain writers modify this general rule by adding that in children the scalp does not escape as often as in the adult. After the healing process there is often left behind an area of lessened pigmentation, which, in many instances, finally assumes the normal, but in the case reported there still is to be found this abnormal appearance on the arm at the seat of the "mother yaw," though five years have elapsed.

The tertiary lesion of yaws is a matter of considerable dispute. Castellani and Chalmers, in the last edition of their classical textbook on tropical diseases, decide that it is a reality, that the tertiary manifestations may be delayed for many years, in some instances, and that the manifestation of the lesion is essentially that of a gumma in syphilis affecting about as many different tissues as in the latter disease. At times there occurs a mixture of tertiary and secondary lesions in the same patient. When the skin is affected with this tertiary manifestation there results a breaking down with the formation of clear-cut ulcers with serpiginous outlines and with subsequent scarring and white markings. When the bones are affected painful nodes develop beneath the skin and a diffuse, chronic periostitis occurs which may cause deformity. Contractures of the muscles are said not to be uncommon. So far no report has been recorded of tertiary lesions of the nervous system or other viscera.

It is a notable fact that yaws is not inherited but rather that it is contracted by the mother from the child. Essentially it is an affection of childhood. It is much more readily communicated than syphilis and in these two modifications are found the chief clinical points of difference. Unlike syphilis yaws does not affect the glandular system with such regularity. The post-cervical and inguinal glands may be affected but not uniformly. When the gland does become affected it is not usual

for the process to go on to suppuration, thereby simulating syphilis.

The prognosis in so far as life is concerned is not grave. In my own very limited experience there was spontaneous healing. Without secondary complications death is said by the authorities not to occur. It is economically very important, however, because it incapacitates the individual for every class of manual labor.

It is in yaws that we see demonstrated Ehrlich's true concept of *therapia sterilans magna*. Nichols used it first in experimental yaws. Strong in the Philippines and Castellani in Ceylon were the first to apply it to man. It is well recognized that salvarsanized serum has a definite curative value. In no other disease have we a better illustration of the specific action of a drug than in the use of salvarsan in the treatment of yaws. In some of the tropical islands the problem is presented to the governmental authorities whether it is better to pay for the expensive drug or to tolerate the disease. With us there can be no doubt that the necessary funds would be at once forthcoming regardless of the economic value of the sufferer.

Much has been written on the subject of yaws since the publication of J. Numa Rat's classical contribution on the subject in 1891. It is thought desirable for the purpose of lessening the labor of the busy practitioner to amplify the chronological bibliography which accompanies Rat's article. No effort will be made to mention every article, but only those of value in acquiring a grasp of the subject. An effort has been made to refer to every article on the subject published in the United States, and, as far as the writer knows, every case originating in this country has been mentioned in the body of the paper.

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A STUDY UPON AMŒBÆ CULTIVATED FROM THE NORMAL HUMAN INTESTINE.*

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In earlier publications, the generic term "Amœba" has included all species of this protozoon whether found in pathological lesions, in the normal intestine of man, or isolated from external sources. Cassagrandi and Barbagallo,¹ finding trophozoit forms of the amœba described by Lœsch in the intestines of healthy individuals, concluded that this species was not pathogenic. Admitting, however, that some difference existed between it and free-living amœbæ, these authors suggested that the generic name "entamœbæ" be given to the parasitic varieties, and that under the term amœbæ should be included those species which, they believed, did not assume the vegetative stage or multiply in human tissues. More recently, following the researches of Viereck,² Hartmann and Prowazek³ and others, several amœbæ have been added to the entamœba group, and lately the tendency has been to further increase the number. If the term "amœba" shall continue to be used will depend, therefore, upon whether known species of free-living amœba cannot assume the trophozoit stage and propagate in tissues and localities where entamœbæ are known to live and multiply. Experiments by the author with free-living amœbæ, cultivated from the intestines of healthy human subjects and of lower animals, and from external sources, would indicate that many species of this protozoon may be propagated in the tissues of man or of lower animals with proper bacterial symbiosis. But whether this symbiosis can change non-pathogenic into pathogenic amœbæ remains to be seen.

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The amœbæ found in intestinal amœbiasis and in tropical abscesses of the liver are, at the present time, accepted as the agents responsible for the lesions. Whether such lesions are induced by the amœbæ or only continued and altered by their presence is disputed by some investigators. The reports of Vedder,⁴ Craig⁵ and others who have described amœbæ in the feces of healthy individuals in widely separated localities, and Walker,⁶ who finds them harbored in the intestines of mammals, birds, etc., without discomfort to the host, suggest that some varieties of this protozoon are innocent invaders and not dormant pathogenic species that may induce lesions under suitable conditions of environment or bacterial association.

The presence of amœbæ in the water supplies of cities, in marshes, upon grass, hay, fruit, vegetables and other sources, has been known long before attempts were made to cultivate them from the tissues of man. Their occurrence in the intestinal contents of man and the lower animals is therefore a logical sequence. However, if all varieties of amœbæ become pathogenic under certain conditions as claimed by Musgrave and Clegg,⁷ it is remarkable that with this wide distribution there should result such a limited number of infections.

With the idea of determining the frequency with which amœbæ are harbored in man without clinical evidence, and under what conditions, if any, they might become pathogenic, the feces of two hundred individuals were examined before and after the administration of a mild laxative. Examinations, after the laxative, as a rule yielded better results.

The subjects were chosen from inmates of the Charity Hospital at New Orleans, students of Tulane University, and individuals not connected with these institutions. Amœbæ in the amœboid and encysted stages were found in 41, or 20 per cent of the cases. A number of these individuals left the institution a short time after examination, so that it cannot be definitely stated that dysentery did not appear at some later period. Those remaining, however, and observed over a period of two to four months, showed no clinical evidence of intestinal upsets.

Fresh preparations of intestinal contents made from these subjects show amœbæ which in size, motility, characteristics of

endo- and ectosarc and of the nucleus of the trophozoites, suggested *Entamoeba coli*. The vacuoles were usually non-contractile, though at times one contractile vacuole was present. Bacteria, leucocytes and cell detritus were in variable quantities in the endosarc. Division into two to eight daughter cells were frequently found in encysted parasites. Free spores were at times numerous, at others sparse. The cysts, although more often round, were in some cases irregularly polygonal in outline. At times both round and irregular forms were present.

Stained smears of active parasites showed a round or oval nucleus, with wide to moderately wide unstained halo and with the chromatin of the karyosome at times abundant, at others rather sparse, with a distinct centriole. Coarse or moderately coarse chromatin dots and strands were present in the endosarc of older parasites and of those about to become encysted.

The cultivation of the parasites was attempted in those cases in which active and encysted amœbæ were present, and positive results obtained in all. Two species were obtained in seven and three varieties were cultivated from three other individuals. Six distinct species were obtained from this series of cases.

In the earlier attempts to cultivate the amœbæ, the alkaline medium of Musgrave and Clegg⁸ was used and their method of planting the infected material carefully followed. Later, the method of Williams,⁹ slightly modified by Walker and myself,¹⁰ was adopted after the associated bacteria had been killed by double normal sodium hydroxid solution or by the Tsujitani¹¹ method.

In the following description of the amœbæ cultivated from these cases, mention is made that some of the species were also recovered from the tissues of man in disease. Comment upon this fact is withheld until further study is made with these amœbæ and their relation to the disease from which they were isolated has been definitely determined.

Description of the Amœbæ.

Amœba I—Gray color, 8.4 to 25.2 microns in diameter. Circular or slightly oval in resting stage, elliptical, fan shape, oblong or very irregular when in motion, sluggishly motile. Pseudopod,

single, lobose or fan shape with fine serrated edge. Ectosarc pale and scarcely noticeable except in pseudopod. Endosarc, finely granular and but slightly differentiated from ectosarc and containing but very few coarse granules. One contractile vacuole. Nucleus indistinct, small, slightly oval or round, surrounded by a small or medium size halo. Encysted forms round, 6 to 9 microns, with finely granular protoplasm and indistinct nucleus. Well-defined cyst wall from which amæba proper is separated by a thin capsule. Under cultivation multiplication occurred by simple division and sporulation. The latter occurs only in first to fourth generation. Spores small, slightly oval; many appearing only as small chromatin masses. Division in the cyst into four or five and seven daughter cells. Answers most of the characteristics of *Amæba fecalis* described by Walker.¹² Cultivated from the intestinal discharge of man in health and in disease.

Amæba II—Gray color, 10.4 to 25.4 microns in diameter. Circular or oval when at rest. Oblong, oval and somewhat quadrilateral when in motion. Actively motile. Pseudopod single, lobose with smooth round edge. Endosarc coarsely granular, contains at times moderate number of spores and a few coarse granules. Ectosarc, ground glasslike, extensive and well differentiated from endosarc. Nucleus round or oval surrounded with a well-defined halo, limited by a thick mass of chromatin. One large contractile vacuole. Encysted stage appears late in cultures. Cyst round in outline, single wall contents coarse to finely granular, multiplication by sporulation for a few generations only and by amitotic division. Species resemble *Amæba cobaye* and possibly *Amæba musculi* described by Walker.¹³ Isolated from intestinal discharge of man in health and disease.

Amæba III—Steel gray, from 7.4 to 24.6 microns in diameter. Resting forms circular. Amæboid forms, quadrilateral, oblong and extremely irregular in shape. Pseudopod, numerous, finger-like, spinose and in a few individuals somewhat lobose. Movements sluggish. Does not wander far from food supply. Ectosarc pale; seen only in pseudopod. Endosarc finely granular barely differentiated from ectosarc, covers pseudopods very quickly. Coarse chromatin granules in large number and few

spores in endosarc; one contractile vacuole. Nucleus small, round or slightly oval; cyst contents finely granular and nucleus indistinct. Cyst wall single and thin. Sporulation sparse, multiplication in cysts more frequent. Division into six or seven daughter cells. Obtained from the intestinal discharge of man, and cat and apple parings.

Amœba VII—Steel gray color; from 18 to 35.4 microns in diameter. Resting stage circular or oval and amœboid stage oval, elliptical and slightly oblong. Pseudopod single, broad and short. Ectoplasm poorly differentiated from endoplasm, lobose in shape. Endoplasm coarsely granular contains numerous spores and coarse chromatin granules. Nucleus distinct, very slightly oval and surrounded by a broad halo, limited by a thin chromatin band. A single contractile vacuole is present. Encysted forms appear early. Cysts hexagonal or irregular polygonal in shape with two distinct walls; an outer thick and wrinkled one touching an irregular and thinner inner capsule at its angles. Contents of cyst coarsely granular, with numerous large chromatin granules and a prominent nucleus. The vacuole is often seen to contract and dilate in the early encysted stage. Spores are numerous, oval shaped and large. Segmentation is frequent. Division into four, five, six and seven daughter cells. Movement is rather active. Cultivated from laboratory sweepings, from the intestinal discharge of man and cat and from an infected amœbic abscess of the liver. Undoubtedly the same species as *Amœba intestinalis* and *Amœba gall-favoris* described by Walker.¹⁴

Amœba IX—Gray colored. From 7 to 22.2 microns in diameter. Resting stage circular in form. Amœboid stage oval, oblong and extremely irregular in shape. Pseudopod fan shape and lobose. Ectosarc visible only in pseudopods; pale and very slightly differentiated from endosarc; edges smooth or slightly serrated. Endosarc finely granular, with coarse chromatin granules; many spores, several non-contractile vacuole. Nucleus round, moderately distinct and surrounded by wide pale halo. Movements slow. Development slow. Encysted stage assumed early. Cysts round; wall single with a thick outer boundary and a thinner inner one. Contents of cyst finely granular with nu-

cleus indistinct. Sporulations frequent. Division into six or eight daughter cells and by simple division. Conforms with description of amœbæ "L" of Musgrave and Clegg¹⁵ and of Walker's¹⁶ *Amœba hominis*, isolated from intestinal discharge of man in health and in dysentery and from an amœbic abscess of the liver.

Amœba XVIII — Gray with a dark or black granule about one-fifth the size of the amœba situated near or partly into the nucleus. From 2 to 5 microns in diameter; resting forms round. When in motion slightly oblong. Endosarc finely granular with very indistinct nucleus. Ectosarc only seen in short lobose or spinose pseudopods. Very small contractile vacuole which may be absent. Actively motile. Development fast, encysted stage assumed rapidly. Encysted forms round with highly refractive outer covering. Cyst contents finely granular. Nucleus almost invisible. Sporulation excessive. Division by amitosis. No other methods of division noted. Rapid development from two to three generations, then suddenly impossible to continue growth. Answers somewhat to the description of *Amœba lobosa guttula* of Celli and Fiocca and *Amœba diaphana* Celli and Fiocca. Cultivated from intestine of man in health in other intestinal diseases but amœbiasis and in amœbic dysentery.

Whether these amœbæ can produce lesions or whether they are harmless commensals can only be determined by their behavior in susceptible animals. In the experiments that follow, kittens, choats and monkeys were used because it has been shown that they are susceptible to infection by material from human cases of frank amœbiasis.

The cultures used were started from one amœba. When a symbiont was required, it was chosen from organisms best suited to the parasite and most likely to produce lesions in the tissues of the host. When pure cultures were necessary either amœbæ growing upon autolyzed tissues were used, or, if cultivated with bacteria, these were destroyed by the action of a double normal sodium hydroxid solution. When the latter method was employed, controls were made to determine whether the amœba had been injured by this treatment.

All the animals were observed for several days and their feces carefully examined and no amœbæ were found. It is possible that in some cases amœbæ had been overlooked; if so they have in no manner affected the results of these experiments.

The experiments were divided into seven groups:

Group I—The animals were fed cultures of one species of amœba in sterile milk and water.

Group II—Animals were given a mixture of several species of amœbæ and their original symbiotic organisms, in milk and water.

Group III—Animals received high rectal injections of suspensions of several species of amœba with one or more symbiotic micro-organisms. The symbiont was chosen from bacteria most likely to produce lesions.

Group IV—Animals were injected into the liver with a single specie of amœba in symbiosis with *V. cholerae*, *B. typhosus*, *B. dysenteriae* or *B. coli*, alone or in combination with each other.

Group V—Animals injected into the liver with encysted amœbæ free from symbiotic micro-organisms.

Group VI—Were first immunized against *B. cholerae* and subsequently, cultures of all species of amœbæ in symbiosis with the cholera vibrio were injected into the liver.

Group VII—Animals injected with the bacteria alone used as symbionts to the amœbæ.

Experiments.

Experiment I—Four kittens had been under observation for ten days during which time their feces were examined frequently for the presence of amœbæ. Forty-eight hours preceding the experiments the animals were allowed nothing but water, when on July 3, 1910, each was fed encysted cultures of amœbæ in milk. The amœbæ were in symbiosis with the various bacteria with which they had been originally isolated. The animals fed freely. Cat "L" was fed Culture XVIII, cat "M" Culture II, cat "N" Culture VII, and cat "O" Culture I.

The animals were observed every second day and their stools examined for amœbæ.

Cat "L" and cat "O" were negative both for amœbæ and

intestinal disturbances and were sacrificed on August 12, six weeks after feeding. The intestines were free from amœbæ and no lesions could be found.

Cat "M" remained well until the 19th day when it developed diarrhea and became greatly emaciated. Examination of the stools failed to reveal amœbæ either in the amœboid or encysted stages, although mucus and some red blood cells were found. Four days later the animal could no longer stand and was sacrificed. Careful examination of the entire gastro-intestinal tract and other organs failed to reveal the presence of amœbæ. Although there was a distinct catarrhal inflammation in both the small and large intestine no ulceration was found.

Cat "N" remained well throughout the whole period of observation although many encysted amœbæ and a few active ones appeared one week after the amœbæ had been fed to it. The parasites were present forty days later when the animal was sacrificed. Active and encysted amœbæ were found in moderate numbers in the colon but there were no evidence of dysentery. The other organs were negative. The parasites were recovered from this animal.

Experiment II—Believing that association with other species and special symbiotic micro-organisms might exert some influence upon the action of these parasites, two kittens were fed encysted cultures of amœbæ XVIII, VII, and I, growing with typhoid, paratyphoid and *B. dysenteriae*, and two others were given a mixture of six species of amœbæ with the same symbiotic micro-organisms but including *V. cholerae*. The animals were fed on August 2, 4, 6, and 8, and their feces examined afterwards.

Kittens "P" and "Q" remained well, although a few active and encysted amœbæ were found in the feces, and in the intestines when the animals were sacrificed two months later. The intestines showed no lesions.

Kittens "R" and "S" had mild intestinal disturbances with loose stools containing mucus and red blood cells and a few amœbæ. Kitten "S" became greatly emaciated and was sacrificed twelve days after feeding. The small and large intestines were congested and oedematous but no ulcerations could be found. Amœbæ mostly in the encysted stage were present in

moderate numbers but none of the few found in the amœboid and resting stages contained red blood cell inclusions. The other, kitten "R," recovered from the intestinal upset and remained healthy until August 30, when it again developed clinical symptoms of diarrhea. The stools were frequent and loose but there were very few red blood cells, a moderate amount of mucus but no amœbæ. Four to five days later the animal recovered and showed no further evidences of intestinal disturbances. It was sacrificed on October 5, fifty-eight days later, after the last feeding. At this time the intestinal canal and other organs showed no evidences of disease.

Experiment III—Kitten "T" was injected in the rectum on August 4 with encysted cultures of amœbæ I, II, and XVIII, in symbiosis with *B. dysenteriae*, *B. typhosus* and *B. paratyphosus*. The suspension was made in a cubic centimeter of sterile saline and injected as high as possible into the rectum. Amœbæ were present in the feces of this animal up to the tenth day when diarrhea set in with frequent loose stools containing red blood cells and a variable amount of mucus. Amœbæ were present in small numbers both in the active and amœboid stages. The diarrhea continued for a few days, then subsided. The animal continued in health and the amœbæ disappeared. Sacrificed twenty-seven days after feeding there were no lesions of the intestines or other organs and no amœbæ found.

Experiment IV—Kitten "U" injected on the same day and with the same amœbæ cultures as kitten "T," but in symbiosis with *V. cholerae*, developed diarrhea four days after injection. Frequent stools with much straining and blood; mucus and amœbæ were found. The amœbæ contained no red blood cell inclusions and disappeared about the time that the dysentery subsided. Two months later this animal was still well and amœbæ were not found in the stools.

Experiment V—Monkey V (*Macacus rhesus*) was fed two encysted cultures of amœbæ I, II, VII, and XVIII, with cultures of *B. dysenteriae*, *B. typhosus*, *B. paratyphosus*, on August 4, 6, and 8. One month later the animal was still unaffected by the feeding and during this time the feces contained a few en-

cysted amœbæ but neither diarrhea, nor other evidences of amœbic invasion was noted.

Experiment VI—Monkey VI (*Macacus rhesus*) injected in the rectum on August 4 with old encysted cultures of the same species of amœbæ as that fed to monkey V, but without symbiotic micro-organisms, showed no symptoms of dysentery although encysted amœbæ were present in the stools for several days following the injection. Two months later the animal was healthy and had showed no evidences of intestinal upsets during this period.

Experiment VII—Monkey VII (*Macacus rhesus*) injected in the rectum on August 4 with encysted cultures of amœbæ I, II, VIII and XVIII, in symbiosis with *V. cholerae*, developed diarrhea on the ninth day after inoculation. The stools contained amœbæ both active and encysted and a good amount of blood and mucus and some polymorphonuclear leucocytes. This animal continued to have short paroxysms of diarrhea which would last for a few days then subside to recur again at later periods. Forty-six days after the injection the animal died of tuberculosis. The large intestine showed a moderate amount of congestion and swelling and small superficial breaks in the mucosa. A large amount of mucus and some amœbæ were present. These were mostly in the encysted stages though not a few were motile.

The ulcerations found were few and scattered over the entire length of the gut. They were small, superficial and showed no distinct undermining. The liver was negative as well as other organs excepting the lungs and spleen, which contained numerous tubercles. Properly stained smears from these organs showed numerous acid-fast organisms, but no amœbæ were found.

Experiment VIII—Five kittens were injected in the liver on March 26 with suspension of encysted amœbæ and *B. dysenteriae*. Kitten "G" received 3 c. c. of the suspension amœbæ II, kitten "I" 3 c. c. of the suspension of amœbæ III, kitten "J" 3 c. c. of suspension of amœbæ VII, kitten "K" 3 c. c. of suspension amœbæ IX, kitten "F" 3 c. c. of suspension amœbæ XVIII, and kitten "E" 3 c. c. of suspension of all species. The six animals were sacrificed on the 10th of April. Kittens "H" and "K" showed necrosis along the tract of inoculation. There was also

a distinct abscess about 2 mm. in diameter along the line of inoculation in kitten "H." Encysted amœbæ and polymorphonuclear leucocytes were found in this abscess and the dysentery organism was recovered. In kitten "K" neither the bacillus nor the amœbæ were present. The remaining organs of these two animals as well as those of kittens "F," "G," "I" and "J" were negative.

Experiment IX—Kitten "A" received in its liver on February 18 3 c. c. of a heavy suspension of encysted amœbæ I, II, VII, IX and XVIII without symbiotic micro-organisms, the bacteria in symbiosis having been killed by Frosch's method and proper controls made. On March 8, twenty days after the inoculation, the animal was sacrificed. Although the point at which the needle entered was still visible, no abscess had formed nor were any amœbæ found.

Experiment X—Kitten "B" was injected in the liver on February 18 with 3 c. c. of a heavy suspension of encysted amœbæ I, II, III, VII, IX R and XVIII and *V. cholerae*. On March 1 the animal was sacrificed. A small abscess found which contained many polymorphonuclear leucocytes, a few active amœbæ, and many encysted forms. The cholera vibrio was recovered from the lesion. The other organs were negative.

Experiment XI—Was fed several cultures of encysted amœbæ I, II, III, VII, IX R and XVIII with cholera vibrio. on January 3, 5, and 9. Three days after the last feeding, encysted amœbæ, a few active amœbæ, red blood cells and much mucus were present in the loose bowel movements. Four days later the diarrhea had subsided and the animal appeared well. On the 23rd day diarrhea again appeared and few encysted and active amœbæ which were found along with *Balantidium minutum* when the animal was sacrificed on the following day. The intestines were congested but the congestion was not limited to the colon, being equally as well marked in the small gut. Small superficial ulcerations were found in the intestine of the animal. The ulcerations though not numerous were scattered throughout the length of the colon but were slightly more numerous in the sigmoid flexure and rectum than in the remaining portion of the organ.

Experiment XII—Fig II. Was fed large amounts of pure cultures of encysted amœbæ I, II, III, VII, IX and XVIII on January 13, 15, 17, and 19. Encysted amœbæ and a few active ones were frequently found but the animal failed to show clinical evidences of dysentery and appeared little affected by the presence of these parasites. When killed, fifty-seven days later, the intestinal canal was normal.

Experiment XIII—Fig III. 10 c. c. of a heavy suspension of amœbæ I, II, III, VII and XVIII, in symbiosis with *B. cholera*, was injected into the liver of this animal on January 15. Fifteen days later the animal was sacrificed. An abscess was found and encysted amœbæ were numerous.

Experiment XIV—Monkey VIII was injected in the liver on January 8 with 5 c. c. of a suspension of encysted cultures of amœbæ I, II, VII, IX R and XVIII in symbiosis with *Staphylococcus aureus*. Ten days later the animal had become emaciated and a large hard mass was felt through the abdominal wall in the right hypochondrium. The animal was sacrificed and an abscess measuring 4 cm. in diameter was found in the liver. The contents of this abscess showed many polymorphonuclear leucocytes and necrotic tissue. Many encysted amœbæ and a few trophozoits were found.

Experiment XV—Monkey II was immunized by subcutaneous injections of *V. cholera*. Cultures of amœbæ A I, A II, A III, A VII, A IX and amœbæ L of Musgrave and Clegg in symbiosis with *V. cholera* were injected into the liver. Twenty-seven days later the animal was sacrificed. Excepting for a small linear scar along the needle's track no lesions and no amœbæ were found.

Experiment XVI—The possibility that amœbæ in their entrance into the liver through the portal vein may obstruct the vessel and produce lesions suggested the following experiments:

Monkeys 11 and 12 were laparotomized and washed cultures of amœbæ A I, A II, A III, A VII and IX cultivated upon autolyzed tissues were injected directly into the portal vein. The animals had uneventful recovery, continued in good health and were sacrificed eight months later. No lesions were found.

Discussions and Conclusions.

In summing up the experimental results of this study, it is evident that if we accept certain definite lesions heretofore ascribed to amœbæ as resulting solely from these protozoa, we must recognize pathogenic and non-pathogenic species. Experimental evidence is too strong to believe that free-living amœbæ or amœbæ cultivated from the intestines of man in health are pathogenic.

Up to the present time no conclusive evidence has been advanced to offset the idea that some bacteria in the intestinal canal may not be the primary etiological excitant in frank amœbiasis. From this study, however, it appears to be well established, that free-living amœbæ and amœbæ cultivated from the healthy intestine cannot produce typical amœbic lesions in the gastro-intestinal canal or the liver of susceptible animals when introduced in pure cultures or with favorable bacterial symbiosis. When either one or several species of amœbæ were fed to animals or injected into their rectum with bacterial associations, the results were negative unless the symbiotic micro-organism was capable of producing an intestinal upset. When pure cultures were used no results were obtained. Animals injected into the liver with suspensions of one or many species of amœbæ either in pure culture or associated with some micro-organism, failed to show lesions when the bacteria were omitted or were not pathogenic. Positive results were obtained only when the bacterium in symbiosis was pathogenic to the host. In every instance, the lesions when present did not suggest amœbic invasion. Negative results followed when the amœbæ and their symbionts were injected into the liver of an animal previously immunized against the bacterium, although lesions followed the injection of the same amœbæ with the same symbiont, in an animal not protected against the symbiotic organism.

Control animals that were fed or injected with the various bacteria used as symbionts, without the amœbæ developed the same symptoms, died as frequently and the lesions were similar to those in which the amœbæ were injected with the special micro-organism.

With the knowledge of the wide distribution of many species of amœbæ and the frequency with which they are found and cultivated from the food of man it is but natural that they should occur in the human intestine. The fact that amœbæ cultivated from the normal intestine, give negative results in animal experiments, suggests that the amœbæ cultivated in dysentery may be of the same species and not the real offenders, and that the pathogenic amœbæ have not been cultivated up to the present time. A study along this line is now under way and the results will be given in a future publication.

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Discussion.

DR. ANDREW W. SELLARDS, Baltimore, Md.: Is it possible to differentiate species in their fresh state?

DR. MAURICE COURET, New Orleans, La. I am often unable to differentiate with absolute certainty the pathogenic species from many nonpathogenic amœbæ in the fresh state, especially if the latter are present in intestinal upsets other than frank amœbic invasion.

Description of Plate.

All drawings were made from plate cultures with camera lucida and 6a Leitz objective.

Fig. 1. Amœba I. Amœboid, resting forms, cysts and spores of an amœba cultivated from the normal human intestine and from amœbic dysentery.

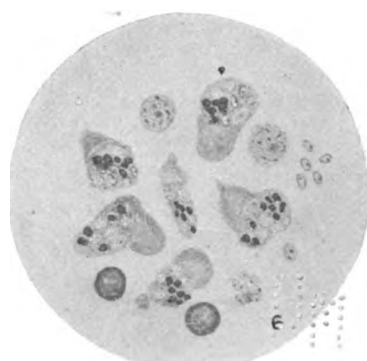
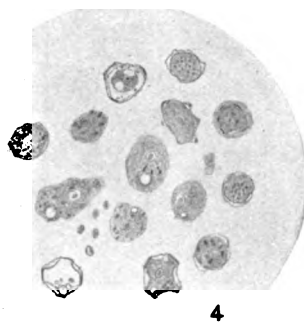
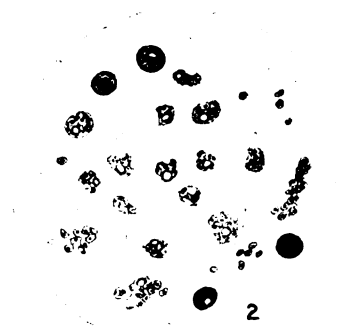
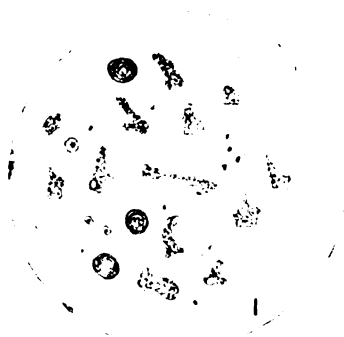
Fig. II. Amœba II. Amœboid, resting forms, cysts and spores of amœba cultivated from intestinal discharge of man in health and disease.

Fig. III. Amœboid, resting forms, cysts, spores, etc., of an amœba isolated from the normal intestinal discharge of man and cats and from apple parings.

Fig. IV. Amœbæ VII, VIII and XV. Amœboid, resting forms, cysts, spores, etc., of amœba cultivated from laboratory sweepings and from the intestinal discharge of man and cats in health and from an infected amœbic abscess of the liver. Note irregular cyst wall.

Fig. V. Amœba IX and XII. Vegetative and resting forms, cysts and spores of an amœba cultivated from the intestinal discharge of man in health and in dysentery and from an amœbic abscess of the liver.

Fig. VI. *Entamœba histolytica* from an abscess of the liver.



ILLUSTRATING ARTICLE OF DR. COURET.

RECENT INVESTIGATIONS IN RELATION TO INFECTIOUS DISEASES IN SOUTH AMERICA.*

By

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The first expedition from the Harvard School of Tropical Medicine to South America in 1913 gave abundant opportunities for the observation and study of a number of infectious diseases occurring commonly in the localities visited. The other members of this expedition were Dr. E. E. Tyzzer and Mr. Charles T. Brues of Harvard University, and Dr. A. W. Sellards, formerly of Johns Hopkins University and now Associate in Medicine at the Harvard School of Tropical Medicine. I shall attempt, with the aid of lantern slides, to describe some of the conditions encountered in the places visited and mention some of the observations made during this expedition.

The first stop was made at Kingston, Jamaica, where most of our time was spent at the Government Hospital, which contains about 250 beds, and which receives cases from all over the island. Malaria is one of the commonest diseases in Jamaica, and placards announcing the sale of quinin may be seen displayed in the post office and other public buildings of the town. Dysentery, amœbic and bacillary, filariasis, elephantiasis, and particularly hookworm infection, also occur.

The disease in Kingston, however, which most interested us from an etiological standpoint was that designated as "vomiting sickness." This affection, it is stated, has been known to occur in Jamaica for many years, but since 1904 it has been more widely discussed in medical literature. More recently the investigations of Scott and Seidelin have attracted attention to it. Scott reported that in several cases of the disease he isolated from the spinal fluid a Gram-negative diplococcus which re-

*Remarks made in connection with a lantern slide demonstration at the annual meeting of the American Society of Tropical Medicine, May 30, 1914.

sembled in many respects Weichselbaum's *Diplococcus intracellularis meningitidis*. In two instances he found a spirochæta-like body or long, curving bacillus in smears made directly from the fluid obtained by lumbar puncture. Seidelin reported the isolation from the meninges of an organism to which he has given the provisional name of *Diplococcus jamaicensis*. However, he states it is quite possible that "vomiting sickness may be due to a blood inhabiting, presumably protozoal, organism, and that a diplococcus infection of the meninges occurs as a frequent complication." Further investigations regarding this condition and its etiology are evidently desirable.

After leaving Kingston, we proceeded to Colon and Panama, where several days were spent in the government hospitals, making observations and collecting material. As the sanitary conditions in the Canal Zone and the diseases prevailing there have already been so widely discussed elsewhere, and are so familiar to many of the members of this Society, I will not take time to refer to our observations made in these localities. In the wards of the Panama City hospital the student of tropical medicine will find much valuable material for study, while in the government hospital at Ancon a large number of cases of malaria are available for observation.

The voyage was next continued down the west coast of South America to Buenaventura, Colombia. This city is situated upon an island at the mouth of the San Juan river, in the region of mangrove swamps. At ebb tide extensive mud flats extend out from the banks of the river on which the town is built. There are no docks and the ships anchor at some distance from the shore. The town is said to have a population of 10,000 at the present time, the great majority of which are negroes. The town has no system of drainage and the back yards of the houses are filthy and filled with rubbish. Mosquitoes and other insects are very numerous about the outskirts of the town and in the mangrove swamps. A large proportion of the inhabitants suffer with skin diseases, of which carate is by far the most common. In this disease pigmented patches appear upon the skin. Sometimes these are slightly raised from the surrounding skin, at other times there is no visible elevation. The patches are usually dry

and sometimes slightly roughened or even scaly. In some instances confusion with vitiligo can be avoided only by the microscopic examination of scrapings from the skin. Sometimes both vitiligo and carate exist in the same individual. The patches in the cases observed varied in color, being sometimes dark or steely blue, at other times black in color. Microscopical preparations and cultures of the fungi from the skin were made in a number of these cases after partial disinfection of the skin. The cultures were never pure, and from our studies it appears that apparently several fungi may enter into the etiology of the disease which in all of its manifestations, at least, must be considered at the present time somewhat obscure. Further investigations will shortly be undertaken regarding this disease. Individuals afflicted with leprosy, frambesia, and chronic ulcerative processes of the skin are not uncommonly seen in a number of the towns along the western coast of South America. The chronic ulcerative processes, apart from those due to syphilis and leprosy, may usually be classified into three types. One of these is related, in etiology at least, to the oriental sore as originally described in India. It is due to a species of *Leishmania*, and the condition it produces is termed in South America "espundia." Another type is that of the phagedenic ulcer, the origin of which is probably due to spirochaetae. A third type is of blastomycetic origin. The lantern slides will give you an idea of the appearance of these different types of ulceration. The cases of leprosy and yaws observed in South America did not apparently differ from cases of this disease observed in other parts of the world.

From Buenaventura we proceeded directly to Guayaquil, Ecuador. Guayaquil is a city of considerable importance from a sanitary standpoint to a number of civilized countries. It is the largest port of Ecuador and is the last port of call of many steamers on the northward route to Balboa and the Panama Canal. At the present time it is one of the most unsanitary cities in the world. It is particularly dangerous for visitors on account of the risk to which they are exposed of contracting yellow fever. The city is situated two and one-half degrees south of the equator, on the right bank of the Guayas river, about forty miles from its mouth. The population is estimated at

80,000. The prevailing diseases are yellow fever, malaria, bubonic plague, dysentery, hookworm disease, and typhoid fever: Cases of yellow fever occurred almost daily during our stay in Guayaquil, and we had opportunities of examining a large amount of clinical material and of obtaining at autopsy abundant and excellently preserved material for histological study. The blood in yellow fever was studied with relation to the presence of parasites, particularly with reference to the existence of the protozoön which Seidelin has described under the name of *Paraplasma flavigenum* as the cause of the disease, and which has very recently been referred to again by Macfie and Johnston. We were unable, however, to detect any bodies which suggested a parasitic nature in the blood in this disease. Cultures were also made from the blood by various modern methods, but no visible, causative organism could be detected.

In the study of the animal parasites harbored by the crocodiles which abound upon the banks of the rivers near Guayaquil, a species of *Linguatula* was discovered. A detailed report of the sanitary conditions observed in Guayaquil, and a description of this parasite, will be referred to elsewhere.*

From Guayaquil we proceeded by boat to Callao, and thence by rail to Lima, Peru. In the latter city and in a number of mountain towns in the interior of Peru a large amount of the work of the expedition was carried on. The diseases particularly investigated in these localities were verruga peruviana, Oroya fever, and uta. Isolation by mountain ranges, together with the unusual climatic conditions which prevail in certain portions of Peru, situated as they are so near to the equator, have undoubtedly exercised a remarkable influence upon producing what is in some respects at least a very unusual fauna and flora, and hence it perhaps is not surprising that unusual diseases should be encountered in these regions.

From remote historical times the inhabitants of Peru have suffered severely from a disease known as verruga peruviana, and characterized by fever, anæmia, and a nodular eruption on the skin. It has hitherto been generally accepted that this dis-

*Report of the First Expedition from the Harvard School of Tropical Medicine to South America in 1913, Harvard University Press, Cambridge, Mass., 1914.

ease in its severe form was preceded by an initial stage known as the Oroya fever stage, or the *fièvre grave de Carrion*. If the individual did not die in this febrile stage the fever abated and then the eruptive or verruga stage of the disease was said to begin. If the eruption is generalized and abundant, then it is stated that the patient is sure to recover. In the chronic or mild type of the disease, which is said to comprise the greater proportion of the cases, there is moderate fever of intermittent or remittent character, and pains in the joints are common; more or less anæmia is present. The eruption is said to be the culminating feature in both types, and it appears under various forms, which, according to the special characteristics they reveal, are termed "miliary," "nodular," or "mulaire."

The cause of the disease was hitherto not definitely known, but the majority of investigators have attributed a bacterial origin to it. Barton described a bacillus as the cause, and later observed bodies in the red cells which he believed to be protozoa: by other observers these were usually thought to be products of cell degeneration. More recently a species of *Leishmania* and one of *Chlamydozoa* has been regarded as the cause of the disease.

After studying these conditions for some time in Peru, our investigations led us to the conclusion that verruga peruviana and Oroya fever represent two distinct diseases. The former we believe is due to a virus which can be transmitted to several of the lower animals, and which produces definite lesions in them. Thus, for example, when the virus is inoculated intratesticularly into rabbits, after an incubation of about 15 to 23 days, a definite lesion usually appears. In dogs also, by the same method of inoculation, a somewhat similar lesion is sometimes produced. However, when repeated inoculations are made from testicle to testicle, the virus becomes attenuated, and inoculations of this nature soon fail. The monkey is the most satisfactory animal for inoculation, and when the skin over the eyes is lightly scarified and a portion of the verruga nodule is rubbed into the abrasions, after an incubation period of from about 15 to 40 days, small papules appear which gradually enlarge and finally assume considerably the appearance of the lesions seen in man. They also have

a similar histological structure to the human lesions. When monkeys are inoculated with the virus an interesting fact is that no generalized eruption of the skin occurs, but as when this animal is inoculated with smallpox virus, a modified form of the disease results. The verruga virus also shows other similarities to smallpox virus. Dr. Tyzzer and I have been able to show that monkeys may be successfully immunized against verruga virus and in every instance when they have been reinoculated no lesion has developed. We therefore hope to have secured a satisfactory method of vaccination of man against this disease. We have stated that the disease verruga peruviana is due to this inoculable virus. The term virus is employed because we have been unable to detect by microscopical examination either in numerous fresh preparations often examined with the dark-field illumination, or in stained preparations made from the lesions, or in cultures made from them, or in sections of the tissues, either spirochætæ or any other definite, visible micro-organism.

The histological study of sections of the lesions also shows that this disease is entirely distinct from Oroya fever. The verruga nodule constitutes a special form of granuloma, characterized in the early stages by the formation of new blood vessels in œdematous, connective tissue, and by marked proliferation of the angioblastic cells, forming masses or islands of closely placed cells. Later there is an invasion of the connective tissue with lymphocytes, plasma-cells, and leucocytes, and as the lesion progresses further, fibroblasts are formed and collagen fibrils deposited.

In Oroya fever, on the other hand, there are no lesions upon the skin in uncomplicated cases. This disease we found to be due to a parasite of the red blood corpuscle sufficiently distinct from the other hematozoa previously described to be placed in a new genus. The organism which we believe to be the cause of Oroya fever produces in man fever, and in severe infections a rapid and pernicious form of anemia which results frequently in extreme prostration and death. So far it has not been transmitted to the lower animals. It is both rounded and rod-shaped, and has been observed in both fresh and stained blood specimens.

and in stained preparations made from the lymphatic glands. To this parasite we have given the name of *Bartonella bacilliformis*. From the lantern slides you are enabled to obtain a clear idea of its appearance. Its characteristics have been fully described elsewhere.*

In Oroya fever marked pathological changes are found in the liver, spleen, bone marrow and lymph glands. The liver shows areas of degeneration of the central type. The spleen is enlarged and shows infarctions. The endothelial cells of the lymphatic glands are greatly swollen and present very striking appearances. It appears that one stage of the life cycle of the parasite is passed within these cells.

Obviously in the time at my disposal I can only briefly touch upon our investigations regarding these infectious diseases. The reader should consult the full report already referred to.

Another disease particularly studied is that one known as "*uta*." *Uta* is an ulcerative disease which has been known in Peru since prehistoric times. Lesions of the malady have been depicted on the "*huacos*" or ancient pottery of the Incas. It has been supposed that this disease was a prehistoric form of syphilis or one of leprosy. More recently it has been regarded as a form of lupus vulgaris, as related to gangosa, or as a distinct infection. Its etiology had not hitherto been determined. The disease begins with a small, insignificant appearing papule, which gradually increases in size, and after a month or two a lesion measuring usually from 1 to 3 cm. in diameter is formed. In this stage of the disease the lesion is covered by a more or less moist, dark crust from which a thick secretion exudes. On removal of this crust a moist, superficial ulcer which bleeds freely is revealed. In neglected cases the ulcerations extend slowly in size and in depth, and the lesion usually becomes secondarily infected with bacteria and sometimes with spirochaetae. *Chrysomia macellaria* then sometimes penetrate into the depths of the lesions, particularly when they occur in the region of the nose and mouth and pharynx. In such cases the ulcerations become very extensive. The soft and hard palate may be destroyed by the extension of the lesion, and the walls

*Loc. cit.

of the pharynx eaten away. In the great majority of cases which are treated the ulcerations do not penetrate to great depth, and when the infective agent is destroyed the ulcer heals by granulation and a scar results. The lesions may be single or multiple, the face, mouth, and lips, ears and neck are more commonly affected, but the ulcerations may occur on the arms and legs. The disease is particularly common in children. Often in the early stages not a single papule is found, but a group of them occupying an area of 3 or 4 cm. in diameter. The ulcers when they have developed do not have a punched-out appearance, but their borders are uneven and ragged. There is usually no marked resemblance between the lesions of uta and those of lupus. Infection can probably occur by direct inoculation, and we usually found when one child of a family was infected the others also either showed the lesions or the resulting scars.

From the study of microscopical preparations made from these lesions and sections of them we were able to show that uta is due to a species of *Leishmania*. We were also able to obtain the flagellate stage of the organism in culture and to inoculate successfully a dog with it.

NEWS AND COMMENT

Lieutenant Douglas W. McEnery, Medical Corps, U. S. Army, has been appointed special health officer of the City of Panama.

Dr. Albert Calmette, director of the Pasteur Institute of Lille, France, is said to be a prisoner of war at Münster, Westphalia.

Dr. George Dock has announced the removal of his offices from 611 Jekerson Avenue to 600 South Kingshighway, Barnes Hospital, St. Louis, Missouri.

From November 24 to January 5, lectures on preventive medicine were given by the Social Service Department of the St. Louis Children's Hospital.

Under the auspices of the New York State Department of Health, a series of lectures is being given at the Albany Medical College, Albany, New York.

Dr. Charles W. Garrison, head of the Rockefeller Hookworm Commission in Arkansas, has been elected secretary and state health officer, to succeed Dr. Frank B. Young.

The *Dietetic and Hygienic Gazette* has been purchased by the Critic and Guide Company and will now be published in combination with the *Critic and Guide* and will be edited by Dr. William J. Robinson.

Dr. Richard P. Strong, director of the Department of Tropical Medicine, Harvard Medical School, has been appointed director of the laboratories of the hospitals and of research work of the United Fruit Company.

A recent inspection of the theaters of New York City showed only 16 violations of the law forbidding the use of a common drinking cup. Of these 16 violations, 14 were in Brooklyn. There were 429 theaters inspected.

The Washington County (Maryland) commissioners have decided that the law compelling vaccination is too drastic and that officials should cease its compulsory enforcement and leave it to the judgment of the individual.

Dr. Phillip E. Garrison, who has been connected with the Department of Tropical Medicine, Harvard Medical School, Boston, is now stationed at the U. S. Naval Medical School, Twenty-fourth and E Street, N. W., Washington, D. C.

The port of Folkstone is being watched carefully, as this is now almost the only port in England open to continental trade and the entrance of passengers. Every means is being taken to protect England from epidemic diseases.

An elaborate public health exhibit was opened at the Chicago City Club on November 30 and will be continued until January 16. The display consists chiefly of charts, maps, models and graphic illustrations, and covers many fields of public health work.

The Bureau of Health, Philippine Islands, has equipped a hospital car. A moving picture outfit and sanitary exhibit are part of the equipment. Native lecturers will accompany the car, which will be sent to every part of the country traversed by a railroad.

The Natchez (Mississippi) Charity Hospital has decided to exclude all cases of pellagra from the hospital, as with the reduced appropriation it is felt that such cases cannot be cared for. The Vicksburg Emergency Hospital took a similar action some time ago.

On account of the rumored spread of cholera in Poland, Hungary and Austria, Italy is inspecting all travelers from these

countries and disinfecting all baggage, etc. All those in the least suspected are held for a definite decision, but no case has yet been found.

The International Public Health Office of Constantinople, Turkey, has been disorganized and members asked to join the medical corps of the Turkish Army. This office has been principally to prevent the entrance into Europe of epidemic diseases carried by the pilgrims to Mecca.

Under the auspices of the Robert Dawson Evans Memorial Department of Clinical Research, Boston, a course of free public health lectures is being given once a week until May 25, 1915. Dr. Allan J. McLaughlin delivered the first lecture on "The Importance of Public Education in the Prevention of Disease."

The New York Bureau of Public Health Education is co-operating with certain training schools and high schools of the city in giving a course in public health, that the pupils may become familiar with the work being done by the Department of Health. One of the Bureau's monographs is used as a text-book.

A new health council has been nominated by the Governor of Massachusetts to coöperate with Dr. Allan J. McLaughlin, newly appointed director of health. The members are Prof. W. T. Sedgwick, Drs. Milton J. Rosenau and David Linn Edsall, Prof. George Chandler Whipple and Drs. William J. Gullivan and Joseph E. Lamoureux.

Dr. Wickliffe Rose, with several other members of the committee appointed by the Rockefeller Foundation to aid the war sufferers, will go to Europe to investigate personally conditions there. They will visit France, Austria, Servia and Russia. They will find the most destitute and needy districts and with a view to sending immediate relief to them.

Unless the South Carolina State Board of Health makes the appropriation advised by the grand jury and the Spartanburg County Medical Society, the work of the Thompson-McFadden

Pellagra Commission will be abandoned. Excellent results have been obtained by the Commission and their disbanding would mean a great loss to South Carolina.

The work of the International Health Commission of the Rockefeller Foundation in eradicating hookworm from Panama is progressing rapidly. Laboratories have been established in Bocas del Toro, Panama and La Chorrera. Great numbers of positive cases are being found and though the treatment is not compulsory, all are urged to take it.

Dr. Louis Schapiro, Milwaukee, Wisconsin, has accepted an appointment on the International Health Commission of the Rockefeller Foundation. He will tour the Southern States with other members of the commission and will then go to Costa Rica to organize the work there. From there he will probably go to the northern part of Egypt.

Santa Monica, California, has adopted the commission form of government and one provision is that the mayor shall serve as health officer. A former provision is that the health officer must be a graduate of a reputable medical college and must have had five years' practice. It will, therefore, be necessary for the mayor to be a physician.

In a lecture given recently by Dr. W. E. Quillian, president of the Atlanta Board of Health, he attributed the wonderful decrease in infectious diseases to the inspection of school children. Against 350 cases of diphtheria last year there is only one this year, and almost as great a decrease is true of other infectious diseases common to school children.

The natives of the Philippine Islands have finally accepted as necessary the hospitalization of cholera carriers. There was a great deal of opposition to this at first, but the measure is now thought to be largely responsible for the reduction in the cases of cholera. Examinations are being made at the rate of almost 2000 a day and 600 carriers have been found and received medical attention.

Dr. Angelo Celli, one of the world's most famous hygienists, died recently in Italy. Dr. Celli was professor of hygiene at the University of Rome and chief of the national board of health. He devoted much time to the study of malaria and was instrumental in gaining government control of quinine and many hygienic movements owe their start to him. Italy will feel deeply the loss of this great scientist.

Dr. George B. Converse, U. S. P. H. S., after several years spent in Iquitos, Peru, has returned to San Francisco. At the request of the Peruvian Government, Dr. Converse went to that country to investigate the unusually high death rate prevailing there—50 per 1,000. Yellow fever and hookworm were the most common diseases. By sanitary methods Dr. Converse succeeded in lowering the death rate from 50 to 21 per 1,000.

A semi-civilized tribe of people dwelling in the mountains near Manila recently appealed to the government for aid. As a race, these people are small and weak and underfed. Their death rate is high and their birth rate very low. Malaria, hookworm, skin disease and tuberculosis are general. The government is to settle them on government land and provide them with clothes, food, quinine, seeds and farming implements.

A Brooklyn milk dealer, after several former offenses, has been sentenced to pay a fine of \$250 and serve three months in the city prison for selling adulterated milk. This same dealer has been fined before for selling adulterated milk, selling milk without a license, and selling raw milk for pasteurized. This last heavy sentence will undoubtedly bring him, and others, to the realization that when boards of health make rules they are to be obeyed.

At the recent annual meeting of the American Public Health Association held in Jacksonville, Fla., Prof. William T. Sedgwick, Boston, was elected president; Dr. C. J. Hastings, Toronto, Canada, first vice president; Dr. Juan Guiteras, Havana, Cuba, second vice president; Dr. C. E. Terry, Jacksonville,

Florida, third vice president; Dr. S. M. Gunn, Boston, secretary (re-elected); Dr. Lee K. Frankel, New York, treasurer. The executive committee consists of Dr. John F. Anderson, U. S. P. H. S.; Dr. J. H. Landis, Cincinnati, and Dr. Alfredo Dominiques, Havana. The next meeting will be held in Rochester, New York.

The work of the Rockefeller Sanitary Commission, for the establishment of which a million dollars was given in 1909 by Mr. John D. Rockefeller, will be terminated at the close of this year. The work will be discontinued in all but eight States and this work will be conducted by the Rockefeller Foundation. In March, 1915, the work of five of these eight States will be discontinued, and the last three will end on June 30. The International Health Commission has been established to undertake health work in all parts of the world and to coöperate with and assist in the development of health departments in all countries.

A letter has been received from the secretary-treasurer of the Medical Association of the Isthmian Canal Zone, Dr. H. C. Clark, stating that it seems very desirable that the society should be represented at the Panama-Pacific Exposition in San Francisco in 1915. It was decided at the November meeting of the society to hold an extra session at San Francisco some time during the Medical Period, perhaps June 14. This date is near those chosen by the American Society of Tropical Medicine and the American Medical Association. It is hoped that all members who possibly can do so will attend and will express their intentions to do so to the temporary chairman, whose name will be announced soon.

A preliminary statement has been issued by the Prudential Life Insurance Company of America regarding its exhibition at the Panama-Pacific Exposition. The exhibit, which will be in the Social Economy Section of the Mines Building, will be divided into ten sections. In this preliminary statement a short description is given of each section. Though they are all of

interest, we quote the one with which we are most concerned. "Section IV.—American Health Problems. This section consists of thirty-two charts, inclusive of every important phase of modern public health activities. The series commences with a chart illustrating the elements of American mortality, followed by several historical charts illustrating the mortality of large cities in general and of New York, Philadelphia,, Boston and New Orleans in detail, for the last century. Other charts illustrate the mortality from smallpox, yellow fever, Rocky Mountain fever, plague, leprosy, pellagra, diabetes, etc. In each case, as far as practicable, the statistical facts are amplified by pathological and other illustrations. The series concludes with four charts illustrating local sanitary progress in detail for Charleston, S. C., Leadville, Colo., Nantucket, Mass., and San Francisco, Calif."

Public Health Activity.

FLORIDA.—*Health Notes*, November, 1914. The Life Extension Institute is organizing a "National Health Guard." Men and women all over the country are asked to join. There are no fees and it is hoped that two million will join. The pledge is: "That I will, in so far as my circumstances and opportunities will permit, make an earnest effort to do these things:

1. To inform myself upon the subject of personal, community and household hygiene, and to myself obey the laws of health.

2. To encourage the practice of individuals having periodic health examinations to upbuild physical efficiency and to detect disease in time to check and cure it.

3. To give support and encouragement, and to urge my friends to do the same, to the public health service and officials who are laboring to protect the most precious asset of the nation.

4. To encourage schools, churches, social and civic bodies and employers to give as a patriotic duty all consistent help in stimulating public interest in and in spreading knowledge of the rapidly advancing science of health and life conservation.

5. To coöperate with and advise the Life Extension Institute in its purpose to reduce life-waste and to guard and strengthen the vitality and vigor of our race."

W. S. A.

KANSAS.—Bulletin of the State Board of Health, November, 1914. During the month of October 401 cases of diphtheria were reported to the State Board of Health. Of this number 270, or 67½%, were school children. This is a strong argument for those who advocate school inspection, since the first month of school shows so large an increase. What appears to be a simple sore throat in one child may mean the death of several children. The enforcement of measures to prevent the spread of this dangerous disease cannot be too rigid and cultures should be made of even the slightest suspects.

NEW YORK.—Weekly Bulletin of the Department of Health of New York City, December 12, 1914. The spreading of disease through crowded cars is one phase of hygiene given too little attention. There can be no doubt that many diseases are spread in this way and that the public service companies should provide sufficient cars to relieve as much of this crowding as possible. There are times when people with colds cannot help sneezing, and the many who cough may or may not have tuberculosis. Besides being uncomfortable and stuffy, they are actually dangerous to health.

SOUTH DAKOTA.—Bulletin of the State Board of Health, October 1, 1914. In an article entitled "Insanity vs. Alcohol," Dr. W. E. Daniels states that in 1908 there were three million five hundred and seven insane persons in the asylums of New York, an increase of one thousand four hundred and fourteen over the previous year. At a rate similar to this, every time our population doubles, the insane will be increased by a multiple of three and the feeble-minded by four. In a recent report of forty of the leading hospitals for the insane the number of inmates was given as 15,353 and alcohol was given as the direct cause, to say nothing of the indirect cause, of 22% of the cases.

CURRENT LITERATURE

THE METEOROLOGY OF MALARIA. — O'Connell (*Jour. Trop. Med.*, 1914, XVII, 321) says that in addition to the mosquito work carried out in the Canal Zone during the year 1912-1913, another anti-malarial work of acknowledged benefit has been slowly progressing; namely, the excavation of the canal itself. This he describes as a huge drain cut through the middle of the Canal Zone, which must have a great effect in drying the soil, and therefore drying the overlying hot atmosphere, for a considerable distance on both sides of it. He gives some tables illustrating his well-known views on malaria. *John M. Swan.*

A CASE OF LEISHMANIA TROPICA WITH A FATAL TERMINATION. — (*Ibid.*, 322.) *Salek*, the Persian name for *Leishmania tropica* or oriental sore, is so common at Teheran that the natives pay little attention to it, and seldom present themselves for treatment unless the ulcer becomes grossly infected with pyogenic organisms. Neligan reports the case of a girl, aged 3 years, who died from tetanus. The only "port of entry" for the infection was an oriental sore of 8 months duration.

J. M. S.

BABESIA OR PIROPLASMA.—Chalmers and Archibald (*Ibid.*, 323) show that the name *Babesia* was proposed for a genus of fungi in 1889 by Trevisan. Consequently, the protozoan organism described by Starcovici, in 1893, must be called *Piroplasma* as first named by Patton in 1895.

J. M. S.

A USEFUL PRESCRIPTION IN CHRONIC MALARIA WITH ENLARGED SPLEEN.—(*Ibid.*) Cantlie gives the following prescription for the treatment of chronic malaria with enlarged spleen:

Quinin hydrochlorid, gr. v to gr. vii

Arsenious acid, gr. 1/36 to 1/24

Compound ipecac powder (Dover's powder), gr. iii to gr. iv

Calomel, gr. 1/10 to gr. 1/6

This prescription is to be given twice a day, preferably at 11 a. m. and at bedtime.

J. M. S.

FURTHER RESEARCHES ON COMBINED VACCINS. — Castellani (*Ibid.*, 326). It is not customary in these columns to abstract papers that appear in abstract in our exchanges; but the reprint of Castellani's paper on combined vaccins, which was originally printed in the *Journal* of the Ceylon Branch of the British Medical Association, June, 1914, is so important that we give the conclusions verbatim.

1. The preparation of combined vaccins is based, I think I may venture to say, on the experimental work I carried out in 1901-1902 in Bonn, in Professor Kruse's Institute, when I demonstrated that in inoculating an animal with two or three species of bacteria—provided a sufficient quantity was given—agglutinins and immune bodies for all the germs were elaborated, the amount of agglutinins and immune bodies elaborated for each germ being nearly the same as in animals respectively inoculated with only one species.

2. I have prepared and used in man the following vaccins:

(1) Typhoid+paratyphoid A+paratyphoid B.

(2) Typhoid+Malta fever.

Typhoid+paratyphoid A+paratyphoid B+Malta fever.

(4) Typhoid+paratyphoid A+paratyphoid B+B. *asiaticus*+B. *columbensis*.

(5) Typhoid+paratyphoid A+paratyphoid B+B. *asiaticus*+B. *columbensis*+Malta fever.

(6) Typhoid+paratyphoid A+paratyphoid B+dysentery Kruse-Shiga+dysentery Flexner+dysentery Hys Y+dysentery Flexner-like No. 1+dysentery Flexner-like No. 2.

(7) Cholera+plague.

(8) Cholera + plague + typhoid + paratyphoid A+paratyphoid B vaccine.

(9) Cholera + plague + typhoid + paratyphoid A+paratyphoid B +Malta fever.

3. The inoculation in man of the above combined vaccins is harmless. The reaction is not severe, with the exception of the "cholera+plague" and "cholera+plague+typhoid+paratyphoid A+paratyphoid B" vaccins, when the reaction is severe, though apparently rather less so than after Haffkine's simple plague vaccine.

4. The combined vaccins I am now using consist of carbolized emulsions of agar cultures in normal salt solution without heating. These emulsions seem to give a less painful local reaction than broth cultures

killed by heat. The presence of 0.5 per cent. carbolic acid is sufficient to kill the germs. The "typhoid+paratyphoid A+paratyphoid B vaccin" is, however, also prepared by heating cultures at 53° C.

5. The individuals inoculated with the above mentioned combined vaccins generally produce agglutins for each species of bacteria, and the amount for each species is not much less than control individuals inoculated with simple "one disease" vaccins. The only exception—though only to a certain extent—seems to have been in the case of the typhoid-dysentery vaccins.

6. Combined vaccins, when efficient, are of practical advantage, saving a great deal of time, and rendering possible a contemporaneous vaccination for several different maladies.

J. M. S.

DRACONTIASIS OR DRACUNCULOSIS: A REVIEW.—McConnell (*Jour. Trop. Med.*, 1914, XVII, 337) contributes a satisfactory summary of the most important points connected with Dracontiasis. The paper is followed by a short bibliography.

J. M. S.

NOTE ON THE PRESENCE OF THE SPIRILLUM OF NORTH AFRICAN RELAPSING FEVER IN THE CEREBROSPINAL FLUID AND SWEAT.—(*Bulletin de la Société de Pathologie Exotique*, June, 1914, Vol. 7, No. 6.) Brault and Montpellier have found spirochetes in the cerebrospinal fluid of two cases out of twenty examined at the hospital of Alger-Mustapha, which is contradictory to the published reports of Ardin-Deltiel, Raymond, and Derrien, though nervous symptoms were present. Spirochetes were also found in the sweat of one patient and tears of another. The authors centrifuged the fluid and stained the sediment by the "Tribondeau" method, which has proven the most satisfactory.

P. L. Querens.

RELAPSING FEVER AND MENINGEAL SYMPTOMS.—(*Bulls. et Mém. Soc. Méd. des Hôpit. de Paris*, May 7, 1914, Vol. 30, No. 15.) Coskinas, while attached to a hospital at Salonica during the Balkan war, had the opportunity to observe numerous cases of relapsing fever amongst the allies' troops which were probably infected by the Turkish prisoners detained at this point. In about seventeen per cent. of the cases observed he records

meningeal symptoms consisting of rigidity of the neck, hyperesthesia, clouded mentality, and positive Kernig's sign, giving it, as we may say, a syndrome of meningeal irritation. In order to eliminate the specific meningitides spinal punctures were made, but the fluid was usually clear with an increased albumin content. According to the author, cases having relapses may also show meningeal symptoms. Clinical descriptions of eight cases accompany the article.

P. L. Q.

NINETY-THREE PERSONS INFECTED BY A TYPHOID CARRIER AT A PUBLIC DINNER.—(*Jour. of the American Medical Association*, Vol. LXIII, No. 18, October 31, 1914.) Sawyer reports an interesting method of tracing a typhoid epidemic caused by a carrier assisting in the food preparation for public dinner. The infecting agent was a dish of Spanish spaghetti prepared by the carrier at her home and which was eaten by the diners. Of about 150 persons partaking of the food, 85, or fifty-seven per cent., developed typhoid fever after eating one or two meals at the church, the greater number being proved bacterially and serologically. The other eight received infection from food carried to their homes by those attending the dinner. The sources of the other foodstuffs used, after being traced, failed to incriminate them. The bulk of evidence fell upon the spaghetti, in which the bacilli were also produced experimentally after it had been contaminated, and it was found that instead of being sterilized by the rigid baking to which it was subjected, the bacilli flourished in the deeper layers where the heat penetrated just sufficiently to incubate the germs. All the persons taking part in the preparation of the meal were subjected to examinations, including bacteriological analyses of the feces and urine, and all proved negative except a Mrs. X, who prepared the spaghetti, whose feces were positive for typhoid; this strain reacted positively to the sera of patients tested. Other interesting data were the short incubation periods of the infection, the majority showing symptoms on the sixth day, and the inefficient sterilization offered by baking under present method.

P. L. Q.

WHY YELLOW FEVER IS ENDEMIC IN THE TROPICAL AND ATLANTIC REGION.—(*Medical Record*, July 25, 1914.) G. Delgado Palacios believes that the epidemicity of yellow fever is largely due to a substance of intestinal origin called cholerythrogen. This substance is produced in the intestinal canal of the majority of people living in the tropical and Atlantic region where yellow fever is found. It is found in the feces and urine of many apparently normal persons. It is a chromogen, yielding by acid hydrolysis a purple substance, cholerythrin. This is the corresponding pigment to uroerythrin of the temperate zone. In the presence of urobilinogen and lime salts, it forms granular concretion resembling intestinal sand. This cholerythrogen exhibits red oxidation or carmine color when heated with a 5 per cent. water solution of caustic soda. Hydrolysis with HCl gives cholerythrin similar to uroerythrin, resembling which it turns successively blue, green, yellow, and finally yellowish brown after oxidation when it is treated with ammonia and alykaline carbonates. Fatal cases of yellow fever show cholerythrogen granules infiltrating the tissue upon microscopic examination. Even the interior of the cells show these granules. The impression of a true pigmentary granule overflow of tissues is the deduction of F. G. Hernandez and F. Guevara Rojas, of the University of Caracas. The author thinks that this pigmentary granule invasion bears a relationship to the fatal anuria when occurring. This cholerythrogen is said to be produced through the activity of specific bacteria which grow in tropical or Atlantic countries more or less associated with yellow fever. The absorption of this climatic substance is said to play a rôle in the existence or nonexistence of yellow fever. No direct relationship between this climatic substance and the *Stegomyia fasciata* can be traced, but the fact that this mosquito grows near human habitations and that Reed met with greatest success when he added fecal matter to his breeding jars, is very suggestive.

R. E. Graham.

BERI-BERI.—(J. M. Little, *Journal of the A. M. A.*, Vol. LXIII, No. 15, October 10, 1914.) The author records the substance of his observations in 220 cases of beri-beri among 5,000

of all kinds treated at the out-patient department of the St. Anthony's Hospital, Newfoundland. He discusses the etiology, symptoms, diagnosis, prognosis and treatment which in general accord with those of the beri-beri of the Tropics. Men and women were affected. Only 93 were admitted to the hospital, with 6 deaths. Of the total number 175 were men and 45 women. Of those admitted to the hospital 75 were men and 18 women. The author considers the cause to lie in the one-sided diet with milled wheat flour. A strange fact which seems so common as to be accepted as a matter of fact is the prevalence of polyneuritis among fowls. Both the wet and dry forms were observed, accompanied by the typical edema and peripheral disturbances. The author, though throwing no new light on the subject, at least reveals the surprising fact that this disease is prevalent so far removed from those localities, the Tropics and sub-Tropics, where one is accustomed to hear most about it. His treatment is a change of diet with fresh meat, legumes and whole wheat bread. He recommends that the latter supplant the milled variety in those localities. L. C. Scott.

THE PATHOLOGIC AFFINITIES OF BERI-BERI AND SCURVY. (*Ibid.*) S. T. Darling, Ancon, Canal Zone, presents an interesting table showing the correlation of symptoms between the so-called nutritional or deficiency diseases. He concludes that they are all gradations between two extremes, beginning with rickets and ending with polyneuritis gallinarum, or with pronounced bone lesions as the predominant symptom at one end and neuritic degeneration at the other end of the series between full scurvy, Barlow's disease, guinea pig scurvy, ship beri-beri and beri-beri proper. The review of the cases of scurvy coming under observation in the Rand district present pathological changes such as Vagus nerve and myocardial fatty degenerations, right heart dilatation and excentric hypertrophy, as well as etiological features which closely ally the disease to beri-beri. The author concludes that "the affinities between the two diseases and certain other cachexias lends emphasis to the opinion that they are all the result of a one-sided and deficient diet."

L. C. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

BOOK REVIEWS

TROPICAL DISEASES. A MANUAL OF THE DISEASES OF WARM CLIMATES.

By Sir Patrick Manson. Fifth edition, revised throughout and enlarged. New York: Wm. Wood & Co., 1914.

This book needs no introduction to the medical profession, since it is from the hand of one of the masters of tropical medicine and has always been a standard work on the subjects discussed. In the seven years that have passed since the previous edition, many advances have been made in all branches of tropical medicine and a new edition became necessary in order to keep Manson's work in the forefront of medical literature. The discoveries concerning kala-azar, some forms of dermal leishmaniasis, the transmission of *Trypanosoma gambiense*, yaws and its spirochete, *Schistosomum japonicum*, and many other discoveries, constituted a large mass of established facts that were entitled to a place in all standard works on tropical medicine. The field of prophylaxis has also received its share of attention. The appendix on protozoa, by Dr. Philip Bahr, is also a valuable part of Manson's book. A full analysis of this splendid work would carry us over the entire domain of tropical medicine. Such is not our purpose. We must content ourselves with signalizing the advent of an old friend in an improved form, which enables it to retain the position that it has always held as a thorough exponent of tropical medicine.

McShane.

INFECTION AND RESISTANCE. An exposition of the biological phenomena underlying the occurrence of infection and the recovery of the animal body from infectious disease, by HANS ZINSSER, M. D. With a Chapter on Colloids and Colloidal Reactions by PROFESSOR STEWART W. YOUNG. The MacMillan Company, New York, 1914.

In establishing the basis for the consideration of the topics discussed in this book, the author premises that there is a very limited group of organisms capable of becoming parasitic on higher animals, and among these a still smaller proportion may become pathogenic, or may cause disease. The classification of parasites is that of Bail, established upon the basis of their relative powers of invading the living body. These include pure saprophytes, pure parasites and half parasites; the ability to invade the economy is defined as virulence, distinguished from toxicity, poisons, not necessarily associated with the power to invade.

In the arrangement of the text there is a logical sequence in the

presentation of bacterial poisons, immunity and resistance, and the methods employed to effect these. Phagocytosis, opsonins, vaccins and anaphylaxis all find place.

The chapter on colloids by Prof. Young opens up the possible relation of these substances to physiological processes of the body. If, as the author states, all biochemistry is in the main colloid chemistry, the application is suggestively interesting. Colloidal substances of food stuffs become converted into cell structures. As the ability to study living processes increases the laboratory side grows more important. The author gives some insight of the colloids in the presence of bacteria and suggests phenomena common in such combinations.

Any contribution to the imminent topic of infection and resistance should be welcome and the work of Zinsser and his collaborator is so full of new thought that it will afford a wide field for students interested.

Dyer.

REPRINTS.

CARTER, H. R. Yellow Fever. (Lectures delivered at the United States Public Health Service School of Instruction.) Supplement No. 19 to the Public Health Reports, September 11, 1914.

GOLDBERGER, JOS. The Cause and Prevention of Pellagra. LORENZ, W. F. The Treatment of Pellagra. LORENZ, W. F. The Cerebrospinal Fluid in Pellagra. Reprint No. 218 from the Public Health Reports, September 11, 1914.

HEISER, VICTOR G. Leprosy. Supplement No. 20 to the Public Health Reports, October 16, 1914.

MOTTER, MURRAY GALT. Hookworm Disease. Reprint No. 224 from the Public Health Reports, October 2, 1914.

PERDUE, E. M. Blood Resistance in Cancer. Reprinted from the *Medical Standard*, September, 1914.

PHELPS, EARLE B. The Chemical Disinfection of Water. Reprint No. 225 from the Public Health Reports, October 9, 1914.

SANDWITH, F. M. The Lettsomian Lectures on Dysentery. Reprinted from the *Lancet*, September 5, 12, 19, and 26, 1914.

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EDITORIAL

Genital Infection in Leprosy.—A knowledge of the methods of transmission of communicable diseases is essential to a precise and vigorous campaign of eradication. This has been forcibly illustrated in the matter of yellow fever, in which the intermediate host has been identified, and means for its destruction devised. In leprosy, however, our knowledge of the method of transmission is not quite so satisfactory, and our efforts at regulation or extermination are not yet characterized by the same degree of exactitude. Isolation remains the mainstay of our procedure in stamping out leprosy. Where isolation is carried out in such a way as not to deprive the victim of a certain amount of comfort and pleasure, it does not appear as a hardship to the unfortunate sufferer; but the problem of easing the sufferings of the three million lepers now in the world is not easy of solution.

Goldschmidt, Stricker, and Morrow called attention to the nasal discharge in lepers, which abounds in Hansen's bacilli, and stressed the importance of the upper air passages as the atrium of infection. In a previous article in this journal, we quoted the findings of the British Commission as proving the cutaneous route of infection, from the bite of some blood-sucking insect. We inclined to the belief that much of the history of leprosy is but one phase of the pernicious activity of the *Cimex lectularius*. It has often been urged (by Ashmead and others) that unclean sexual contact is responsible for a part of the leprosy extant; and this point has recently received striking confirmation from Dr. E. Jeanselme in the *Bulletin de la Société de Médecine Exotique*, No. 7, 1914. We quote very freely from his valuable contribution, which goes to argue strongly for the prevalent belief among the Chinese and Japanese that leprosy spreads largely by sexual contact.

In subjects suffering from tegumentary or mixed leprosy, tubercles on the glands are very common. About fifteen years ago, in Indo-China, Jeanselme found that some of these lepromata could invade the navicular fossa and set up a leprous urethritis.

In 1902, in a monograph written in collaboration with Dr. Marcel Sée, he said: "Often the meatus seemed to be tunneled through a large tubercle, resembling a chancre, and from the middle of it a drop of pus could be squeezed; myriads of bacilli were found in this pus."

Notwithstanding its importance, this channel of infection seems not to have attracted the attention of leprologists. Leloir, in his *Traité pratique et théorique de la lèpre* (1886) speaks of the frequency of leproma of the genital organs, but he does not mention a single case of leprous urethritis.

J. Jadassohn, of Berne, in a very recent monograph (1913), confines himself to a mere mention of what Jeanselme wrote on leprous urethritis in 1902.

In spite of extensive researches of books and periodicals devoted to the study of leprosy, only a single case of leprosy urethritis was reported by M. Throux, in 1903. The patient was a Malagassy attacked with the mixed form. He said: "The meatus was contracted, micturition was painful, and the patient says that he has a chronic blenorragia which dates from the time of puberty. The thickenings of the mucosa of the glans, as well as the drop from the chronic urethritis of this patient, contain numerous bacilli of Hansen."

This rarity of leprosy urethritis is more apparent than real, and, therefore, Jeanselme feels that the following observation will be useful.

The patient was a man of fifty-five, a native of the Argentine Republic, where he contracted the disease about fifteen years ago. About two years ago, he left his own country and went to France to live.

This man's skin was speckled with numerous copper-colored spots and large anesthetic tubercles. Repeated attacks of lepromata have made both corneas opaque. The cubital nerves were enlarged and moniliform. Leprosy rhinitis was very marked.

Up to this point the case offered nothing unusual, but the patient called attention to a symptom that is not common in leprosy. For six months, urination has been difficult, and the stream of urine very thin. The glans was covered with lepromata. One of these surrounded the meatus, and infiltrated the urethral wall for a distance of a centimeter. The consistence of this mass was very much like that of a chancre of the canal. This leproma had gradually encroached on the meatus. A few drops of thick, grayish pus were squeezed out and examined under the microscope after being stained in the following manner: in Ziehl's solution for ten minutes; prolonged decolorization in 25% nitric acid; then absolute alcohol; finally, counter-stain by methylene blue.

The floor of the preparation was composed of very numerous intact polynuclears, macrophages, and large epithelial cells with a large, clear nucleus.

On each smear, bright red bodies were easily found, standing out boldly on a blue field. Each such body was rounded, and formed by the agglomeration of straight, homogeneous bacilli, in bundles, the general aspect of which was that of a prickly ball.

There were about a dozen of these balls in a drop of exudate. They were attached to the nuclei of the polynuclears and the macrophages. No isolated bacilli were found anywhere. The bacilli retained the Ziehl coloration tenaciously in spite of the prolonged nitric and alcoholic decolorization; which fact, coupled with their mode of grouping, obviates confusion with tubercle bacilli, with other acid-fast (smegma), and pseudo acid-fast bacilli.

From the foregoing it follows:

1. That the bacilli were the true Hansen's bacilli;
2. That the masses of bacilli were very numerous, and composed of bacilli uniformly stained along their entire length, which would indicate that they were alive.

The etiological importance of this bacilliferous urethritis was all the greater because the patient was still at the height of his sexual activity.

It is not at present known how often leprous subjects have a urethral or vaginal source of infection. Isolation, however, would fulfill all the requirements of the case as a prophylactic; but how can anyone follow up the path of such a case as Jean-selme's, and check off the amount of damage done before isolation is put into practice? That single authentic case should suffice to set on foot a systematic examination of all lepers for possible involvement of the sexual organs; and where such is found to be the case, compulsory isolation should be insisted on.

It is humane to provide generously for the unfortunate victims of this loathsome disease; but it is only common sense, and plain justice to unsuspecting healthy persons, to put such centers of infection in a place where they can enjoy, not only a comfortable existence, but also advanced medical treatment, which is no longer hopeless.

McShane.

ORIGINAL ARTICLES
ON THE FILTERABILITY AND BIOLOGY OF
SPIROCHÆTES.*

By

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Contents.

Introduction.

Spirochæta duttoni, filterability, morphology and distribution in ticks.

Spirochæta elusa, filterability, morphology and biology in cultures.

Spirochæta biflexa, filterability, morphology and biology in cultures.

A new filterable spiral organism from human feces, filterability, morphology and biology in cultures.

Discussion and conclusions.

The subject of filterable micro-organisms is one of great interest and occupies an extensive field in research. That all filterable micro-organisms are not absolutely beyond the limit of microscopic vision has been known since Nocard and Roux¹ cultivated the organism of pleura pneumonia of cattle, and recently Flexner and Noguchi² have made visible the virus of infantile poliomyelitis.

The possibility of easily visible micro-organisms having a sub-microscopic filterable stage has been naturally considered, especially in connection with spirochætes. That an infective stage of relapsing fever spirochætes may pass through a Berkefeld filter was first stated by Novy and Knapp³ and later by Breinl and Kinghorn.⁴ This fact gave support to the theories held by Leishman,⁵ Balfour,⁶ Hindle,⁷ and Fantham,⁸ that the chromatin-like granules in blood spirochætes of man and of fowls, are a definite stage in reproduction and that these granules when cast off are capable both of independent reproduction as such and of developing into spirochætes.

The subject is one of great importance because of its bearing upon the classification of the spirochætes under consideration. If the granules could be proved to be a stage in reproduction,

*Read at the Eleventh Annual Meeting of the American Society of Tropical Medicine, Boston, May 29 and 30, 1914.

it would furnish almost indisputable evidence of their protozoal nature; on the other hand, to prove that the granules are not essential to explain the facts leaves the question still open, with the weight of evidence in favor of bacterial affinities as asserted by Novy and Knapp.³

Because of the bearing upon the classification and of possible value in the consideration of filterable viruses, the writer feels warranted in collecting and summarizing work, published and unpublished, done by him in whole or in part. The matter to be presented does not form a completed whole, but the facts are sufficient to give important suggestions and to indicate the probable truth.

Spirochæta duttoni, Morphology and Distribution in Ticks.

To obtain information regarding the significance of the granules, a series of ticks (*Ornithodora moubata*) inoculated by feeding upon animals infected with *Spirochæta duttoni* (strains of Todd and Koch) were studied in section by means of a special technic.⁹ This technic gives the spirochætes stained in section and makes it possible to determine accurately their distribution. (Fig. 1.) The findings of spirochætes in teased preparations of organs as usually employed, does not locate them accurately and false conclusions have been drawn because it has often been assumed that the spirochætes seen came from epithelial structures, while as a matter of fact they came from the supporting connective and muscular tissues. My results support those of Marchoux and Couvy,¹⁰ who worked with fowl spirochætes in the tick *Argus persicus*, in disproving that the granules found in epithelial cells come from spirochætes. My work shows that the spirochætes do not multiply in epithelial cells, a fact not possible to show by methods previously employed. It also proves that the spirochætes migrate through all the organs and ova of the tick and that all the phenomena of transmission can be explained by this fact alone. On the other hand, large granules, coiled and so-called "encysted" forms derived from spirochætes were found in various muscular and connective tissue of the ticks. (Fig. 2.) These coiled and "encysted" forms are like those seen with spiral organisms of various sorts and probably

have nothing to do with multiplication; an inference justified by our work with cultures described below.

***Spirochæta duttoni*, Filterability.**

Todd and myself¹¹ found that *Spirochæta duttoni* in an infective form can be forced through a Berkefeld filter by pressures of over fifty pounds to the square inch. The filters used were "N" and "W" grades. Positive results were not obtained by atmospheric pressure. After these results were published, Todd (personal communication) succeeded in finding spirochætes in the filtrate of one experiment in which the control bacteria did not pass through the filter.

It would have been impossible to have investigated further the question of filterability with the pathogenic spirochætes. Fortunately, while searching for free-living filterable organisms, two different spirochætes were isolated which were described as *Spirochæta elusa*¹² and *Spirochæta biflexa*.¹³ The former has been kept under cultivation since its isolation, fifteen months; the latter was kept alive for a period of several months.

***Spirochæta elusa*, Morphology and Biology.**

In the description of *Spirochæta elusa* the question of nomenclature was briefly discussed and it was acknowledged that in calling this organism a spirochæte we were taking the license in nomenclature afforded by our imperfect knowledge of spiral micro-organisms and the loose application of the term spirochæte, as employed by others.

"Strictly speaking, our organisms in the pressure of the terminal flagella, circular cross section, and in the preservation of the spiral form under varying conditions, corresponds more closely with treponema than to spirochæta in the sense of Ehrenberg, but since treponema with many authors indicates protozoan affinities, we thought it best not to use this term."

Spirochæta elusa grows well in a dilute hay infusion of neutral or slightly acid reaction, sterilized by filtration through porcelain. It also grows upon the surface of hay infusion agar and the colonies are similar to colonies of bacteria. (Fig. 3.) Thirty

degrees centigrade is the most favorable temperature for growth. The reaction of the medium is not changed.

The organism consists typically of a spiral with four to fifteen complete turns and is from six to fifteen microns long. (Fig. 4.) The body is circular in cross section. The ends taper slightly to rounded terminations. There is a single flagellum at each end, which can be stained by the method employed for staining flagella of bacteria.

Multiplication takes place by transverse division. The details have been described in the earlier publication. Nothing suggestive of longitudinal division has been seen either in living or stained preparations of the organism when grown in liquid media. From hay infusion agar, intertwined forms occur which may simulate longitudinal fission.

While the spirochaetes in the living state keep their form, in cover glass preparations the spirals flatten out considerably, showing some degree of plasticity. The best stains are dilute carbol fuchsin and Giemsa's stain. The latter, after osmic acid fixation and decolorization, leaves the body of the spirochaete with a bluish tinge, and the granules, which can also be seen by dark field illumination, red. The granules are a prominent feature in the morphology, as are lateral budlike processes or projections and swelling (Fig. 5) and coils. (Fig. 6.) These morphological features are striking and reproduce in every detail the large variety of forms encountered with pathogenic spirochaetes. The coiled forms, which are surrounded by a cystlike investment, demonstrable both by the dark field illumination and by staining, are like those first described by Dutton and Todd with *Spirochaeta duttoni*,¹⁴ while the lateral processes and terminal swellings are like those seen in spirochaetes of all sorts and recently described in detail for *Treponema pallidum* by Meirowsky.¹⁵ Many attempts to prove that these coiled, "encysted" and swollen forms are capable of reproduction, or even are viable, failed. If they are viable, they have no greater resistance to deleterious agent than the spiral forms.

This evidence carries with it the suggestion that the similar forms seen in ticks with *Spirochaeta duttoni* are also non-viable.

The motility of the *Spirochaeta elusa* is probably wholly

flagellar in origin. There is a rapid rotation about the longitudinal axis which could be studied when retarded by making preparations for dark field illumination in agar jelly. The progressive motion is rapidly and abruptly alternated forward and backward. The longer forms show sinuous movements of the bodies as a whole, though there is no change in the pitch of the spirals.

***Spirochæta elusa*, Filterability.**

The spirochæte passes through the Berkefeld N and W filters. At first it was impossible to ascertain in what form the spirochæte passed the filters, though in our first paper we stated that it seemed fairly certain that the spirochætes pass through the filter as spirochætes. Repeated filtration has greatly enhanced the motility and filterability so that whereas in the earlier generations the proportion of successful to unsuccessful filtrations was as 12 to 2, after about seventy-five passages through the filters there was practically 100% of successful filtrations. We are here probably dealing with a process of selection, each culture developing in a filtrate of course being the descendant of the more filterable and, therefore, the more plastic or flexible individuals, because it has now become very simple to demonstrate that the spirochætes actually pass through the filters and they do so in such large numbers that they can be found without difficulty and without centrifuging.

It has also been possible to demonstrate the spirochætes deep in the filter wall. (The method is to fix the spirochætes with alcohol in the filter after filtration, stain with dilute carbol fuchsin by running the stain slowly through the filter, drying and embedding in xylol-colophonium. The xylol is driven off by heat until the colophonium sets hard upon cooling. The filters then may be sawn into slices which, after mounting on glass by heat, are further reduced by filing and grinding on carborundum stones of different grades until thin enough for microscopic purposes.)

Repeated filtration has also increased the motility of the spirochætes, whereas transplants of the original strain carried along without filtration have almost completely lost their motility.

The details of these filtration experiments will be reserved for another publication. The methods employed were filtration by gravity, atmospheric pressure, and positive pressure of twenty-four pounds. Each experiment was controlled by adding cultures of *B. prodigiosus* to the culture before filtrations.

***Spirochæta biflexa*.**

Spirochæta biflexa resisted every attempt at sub-culture, though over a hundred different conditions were provided, all based upon the character of the filtrate in which the growth occurred. This spirochæte was characterized by the extreme closeness of the turns, its small size, and curved or flexed extremities. A few spirochætes with terminal swellings were found and also spirochætes containing deeply stained chromatophilic granules. (Fig. 7.) The size was very uniform, six to eight microns long, the number of complete turns twenty-two to thirty-two. (Fig. 8.) This spirochæte showed translatory movements in either direction of the long axis as well as an extremely rapid rotation about the long axis.

A New Filterable Spiral Organism from Human Feces: Morphology and Biology.

A third type of free-living spiral organism was obtained with the help of Dr. R. S. Austin, from human feces on two occasions from different individuals. This organism is almost constant in human feces and has been repeatedly seen by us in dark field illumination and in stained preparations. Morphologically in preparations from feces it would be considered a spirochæte.

It is possible that this organism is similar to those described in stools from normal and pathological cases, in 1893 and 1894 by Kowalski,²² Abel,²³ Aufrecht,²⁴ Escherich,²⁵ Lustig and de Giaxa,²⁶ and Rechtsamer.²⁷ All of these observers agreed as to the probable identity of the organisms they described. Each was called spirillum though placed in the same class with *Spirillum* (*Spirochæta*) *obermeieri*. Cultures were not obtained.

The attempt to isolate this organism was made upon the assumption that it also might prove to be filterable. Berkefeld N

filters were used and the feces were diluted with an equal part of sterile bouillon and filtered first through filter paper. The Berkefeld filtrations were done by gravity. Thirty-eight samples of feces were employed; two gave filtrates containing only spirochaetes after incubation. The time of filtration was three to six hours.

The organism grows well at 37 degrees centigrade in meat infusion bouillon; best when the reaction is slightly acid. In acid broth the medium remains clear and growth takes place in stalactite form from the surface (Fig. 9) or as a white tenacious slime at the bottom. The slime, when the tubes are shaken, rises in a ropelike, stringy mass. Fig. 10.) The broth in old cultures becomes syrupy in consistency and yields a flocculent precipitate upon adding acetic acid. Old cultures have a peculiar fragrant odor reminiscent of the trailing arbutus.

Slime production is much less abundant in neutral or alkaline bouillon and the medium becomes uniformly clouded. On solid media the colonies are glistening, moist, circular in outline, raised, with a central nipplelike elevation. (Fig. 11.)

The organism is also very motile and exhibits rotatory and translatory motion like that of *Spirochæta elusa*.

None of the usual substances used to differentiate bacteria are fermented: The media became more alkaline with the following test substances: dextrose, mannite, lactose, maltose, saccharose, dextrin, inulin, adonite and raffinose. Both strains were tested in duplicate and titrated against control tubes, one set after ten days and another after twenty-seven days incubation. The details will be omitted here. The results were about the same irrespective of the test substance. The media changed in reaction from about 1% acid to about 0.5% acid, to phenolphthalein.

The morphology is that of a relatively thick spiral with pointed ends, the length ranges between two and one-half and three and one-half microns, with from two to four complete turns (Figs. 12 and 13), though there are frequent longer forms with from five to ten complete turns. The organism, no matter how short, is always spiral, i. e., three dimensional. The pointed ends stain less deeply than the middle portions and suggest the

“periplast” described with some pathogenic spirochætes. It is also possible in favorable preparations to trace this faintly staining material along the spirals as if it were a true sheath. There is a single long flagellum at each end demonstrable by bacteria flagella staining methods.

The best staining methods are dilute carbol fuchsin and Giemsa's stain. The latter shows occasional chromatoid granules. A few rounded forms and spirals with swollen terminals are found in cultures several days old. In cultures of two weeks or more, both in solid and in liquid media, the spirochætes completely disintegrate. All that can be demonstrated by stains from such cultures are debris and granules which with Giemsa's stain, color red. These cultures do not revive on transference to fresh media.

Feces spirochæte: Filterability.

The pure cultures of these two identical strains were also filterable through Berkefeld filters in one and a half to three hours by gravity. In nineteen experiments eleven gave positive filtrates, three were negative, and five were positive with contaminations.

Discussion.

The only cultivated micro-organism described that resembles this spirochæte from the feces is the *Spirillum concentricum* of Kitasato,¹⁶ which came from putrifying cattle blood. The resemblance holds for general morphologically only. Kitasato's organism is much longer, grows best at room temperature and the colonies are different. It agrees in having pointed ends and in having at least two or three complete turns. No mention is made of flagella, though the organism was actively motile. Kitasato calls the organism a “true (*echtes*) spirillum.” In our first account of *Spirochæta elusa*¹² attention was drawn to *Spirillum rubrum* of von Esmarch¹⁷ because of some resemblance between this organism and *Spirochæta elusa*. The former, however, is a short, curved or “s” shaped organism containing a bundle of flagella at each end. At the time when Kitasato and von Esmarch published, the known pathogenic spirochætes were

called spirillum, and their choice of names is of no assistance at the present.

The two free-living filterable organisms which we have cultivated show important and obvious differences from spirochæta in the sense of Ehrenberg and from the pathogenic blood spirochætes, for example the axial thread of *Spirochæta plicatilis* is lacking and the movements of the blood spirochætes show much more flexibility by change of pitch of the spirals, and contortions of the body as a whole, than do our organisms.

Our spiral organisms, however, differ in so many respects from cultivated spirilla that we are loth to accept the term spirillum. We have made comparisons with as many spirilla, of which the published accounts seemed to show resemblance to ours, as we could obtain through Kral's laboratory. These were the *Spirillum rubrum* of von Esmarch¹⁷ and *Vibrio lingualis*, and *Vibrios saprophilis alpha* and *beta* of Weibel.¹⁸ The minute *Spirillum parvum* of von Esmarch¹⁹ which was filterable through Berkefeld filters is quite different morphologically, the characteristic form being that of a comma bacillus, smaller than ordinary spirilla.

Attempts at comparison with described spirochætes other than blood spirochætes have been unenlightening because descriptions have been so nearly wholly based upon stained preparations only. Some spirochætes described bear a striking resemblance to *Spirochæta elusa*, particularly the mouth and balanitis spirochætes described by Hoffman and von Prowezwk.²⁰ Their figures 2 and 4 of *Spirochæta balantidis* and figure 13 of *Spirochæta buccalis hominis*, in the size, type of spirals, and flagella, bear close resemblance to *Spirochæta elusa*, as do some of the spirochætes described by Wolbach and Todd²¹ and others in tropical ulcer. As has already been pointed out with *Spirochæta elusa*,¹² both of our cultivatable spiral organisms resemble treponema more than spirochæta, because of the "terminal flagella, circular cross section and in maintenance of the spiral form under varying conditions."

Of the bacterial nature of these filterable spirochætes there can be no question in the light of the manner of growth and the characteristics of the colonies. Yet *Spirochæta elusa* shows every

morphological appearance obtainable with any of the pathogenic spirochætes and with *Treponema pallidum*, so that these latter organisms may also be bacterial in their affinities. Yet our filterable organisms have some properties which distinguish them from bacteria including the spirilla.

1. While not as flexible as true spirochætes they are more plastic than ordinary bacteria, as their power of passing through the filters proves.

2. They are true spiral organisms, not merely comma bacilli or organisms which exceptionally show spiral forms.

3. They are more susceptible to deleterious influences and are less easily stained than most free-living bacteria and exhibit all the morphological peculiarities of spirochætes, such as granules, coiled forms, budlike processes and terminal swellings.

They seem to be intermediate between spirillum and pathogenic blood spirochætes, such as *Spirochæta obermeieri*, *Spirochæta duttoni* and *Spirochæta gallinarum*. It is probable that a new genus can be established, but further work is necessary. Comparisons with cultures of the pathogenic and saprophytic spirochætes, which Noguchi has obtained, may be of material assistance here.

Treponema for reasons already given¹² should be left for the present to include pathogenic spiral organisms having the characteristics set by Schaudinn, flagella, no undulating membrane and fixed spirals.

Our present conclusions are:

1. That the method of filtration as a means of separating spiral organisms from ordinary bacteria will probably hold good for other saprophytic and pathogenic spirochætes and allied micro-organisms.

2. That organisms larger than many bacteria will pass the Berkefeld V, N, and W filters, namely, *Spirochæta duttoni*, and the ones we have tentatively called *Spirochæta elusa*, *Spirochæta biflexa* and the spiral organism from the colon of man which is probably the organism commonly recognized in preparations as an "intestinal spirochæte."

3. That there is no evidence of spirochætes multiplying by any other method than single fission. It is certain that the gran-

ules, coiled forms and swollen terminals of the spiral organisms cultivated by us are not capable of multiplication in any form.

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Description of Plates.*

PLATE I.

Fig. 1. *Spirochæta duttoni* in ganglion cell, cortex of brain of tick, thirteen days after feeding upon an infected rat. 2000 diameters.

Fig. 2. Spirochætes, granules, soiled and "encysted" forms in connective tissue near Malpighian tubule in tick sixteen days after feeding. Koch strain of *Spirochæta duttoni*. 2,000 diameters.

Fig. 3. Hay infusion agar, colonies of *Spirochæta elusa* thirty-seven days growth.

Fig. 4. *Spirochæta elusa*. Typical hay infusion culture. 2,000 diameters.

Fig. 5. *Spirochæta elusa*. Old hay infusion cultures. To show the terminal swellings, coiled forms and deeply staining bodies. 2,000 diameters.

PLATE II.

Fig. 6. *Spirochæta elusa*. Coiled and "encysted" spirochætes from a culture kept in a vacuum at 30 degrees C. for twenty-four hours. This culture was a dextrose hay infusion culture of six days growth. 2,000 diameters.

Fig. 7. *Spirochæta biflexa*. Giemsa's stain after osmic acid fixation. 2,000 diameters.

Fig. 8. *Spirochæta biflexa*. Photomicrographs, dark field illumination. The spirochætes were killed by fumes of osmic acid and mounted in agar jelly to make them stable. Optical system and camera extension calculated for 1,000 diameters.

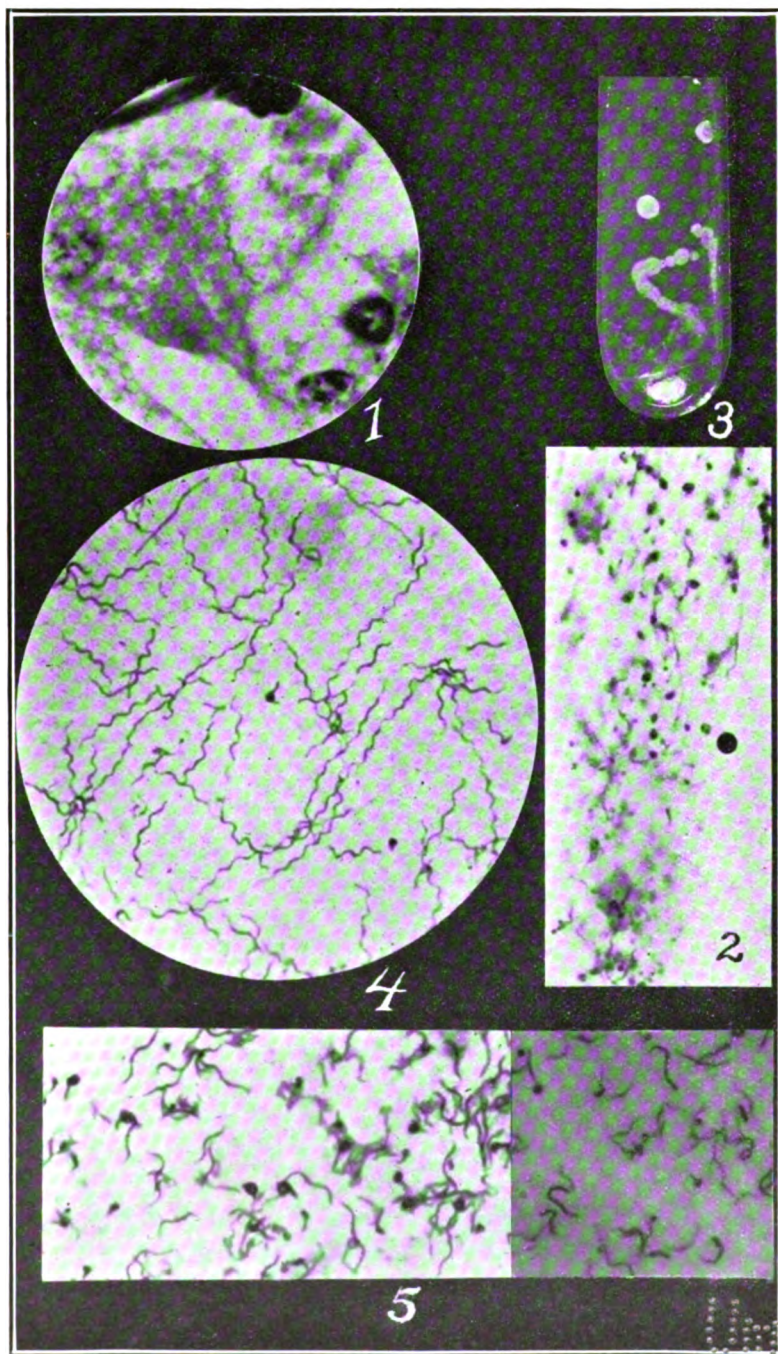
Figs. 9 and 10. Broth cultures of spiral organisms from human feces.

Fig. 11. Colonies on agar, spiral organism from human feces, enlarged five diameters.

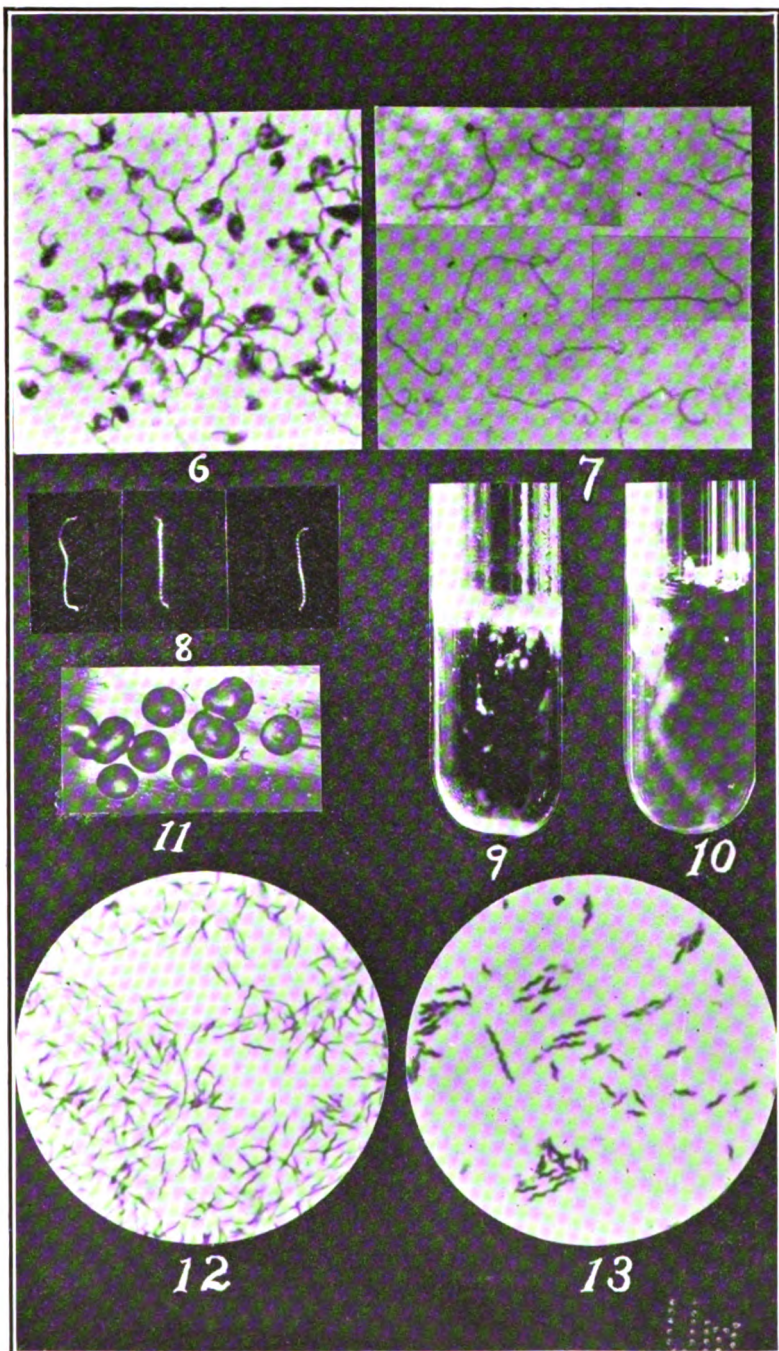
Fig. 12. Spiral organism from human feces, growth on agar. Giemsa's stain. 2,000 diameters.

Fig. 13. Spiral organism from human feces, broth culture. Giemsa's stain. 2,000 diameters.

*Cuts are reduced to three-fourths of their original size.



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NOTE—In a paper which has appeared since this article was written (*Annals of Tropical Medicine and Parasitology*, Vol. VIII, No. 3, December 15, 1914), H. B. Fantham comments on a previous paper of mine (The Distribution and Morphology of *Spirochæta duttoni* and *Spirochæta kochi* in Experimentally Infected ticks (*Ornithodora moubata*), *Journal of Medical Research*, Vol. XXX, No. 1), which contains some of the evidence upon which the present paper is based. Fantham's comments would lead one to believe that my conclusions regarding the multiplication of spirochætes in the epithelium of the Malpighian tubules of ticks were made from a single tick forty-seven days after feeding upon an infected rat. It is clearly stated in my paper that these observations were made upon ten ticks known to have ingested blood containing spirochætes and which were dissected from two to forty-seven days after feeding. In the same paragraph in which this statement is made there is also the statement that in no instance was a spirochæte found in the cells of the Malpighian tubules.

This correction is of importance because Fantham's comment is to the effect that I may have overlooked spirochætes which had been present at a period earlier than forty-seven days.

Another comment of Fantham's would lead one to believe that the technic employed by me for the demonstration of spirochætes in sections of ticks, is recommended for cytological work. The conditions as employed by me apply only to the staining of spirochætes. It is quite probable that cytologists would object to the shrinkage caused by a prolonged stay in alcohol corrosive, and I quite agree that they would not recommend this technic for some of their purposes.—*S. B. Wolbach*.

THE ACTION OF LIGHT ON PROTOPLASM.*

By

W. T. BOVIE, Ph. D.

Research Fellow of the Cancer Commission of Harvard University.

When discussing chemical or biological effects of light we include with the visible electromagnetic waves the invisible infra-red and ultra-violet light waves as well. We also hear of "Röntgen or X-light," and we might with perhaps equal propriety speak of "gamma-light" from radio-active substances. In this paper we will discuss some of the effects of visible and ultra-violet light upon protoplasm. The figures 1 and 2 have been prepared to show the relation between these various "light" waves and other electromagnetic waves. The descriptions of the figures will be found in the explanatory notes which accompany them.

Electromagnetic waves are detected and investigated by the resonant vibrations which they set up in objects upon which they fall. It is necessary that the object used as a detector be capable of vibrating (electromagnetically) with the same, or with some multiple of the same, frequency as the waves which fall upon it. Any object capable of vibrating can always be set in motion by a train of vibrations which are of the same period, as when a note played on a musical instrument causes the same note on a neighboring stringed instrument to sound. The individual impulses, though very feeble, are added together, as when a child moves a heavy swing by pushing always at the moment when the push has the greatest effect.

Electromagnetic waves have no effect upon objects which are incapable of vibrating in resonance with them. The wave passes through the object, and the object is said to be transparent to the particular wave-length in question; for example, rock salt is transparent to heat, to visible, and to ultra-violet waves; ruby glass, to red light waves; paraffin wax, to Hertzian waves; white fluorite, the most transparent substance known, to heat, to vis-

*Presented to the Eleventh Annual Meeting of the American Society of Tropical Medicine, Boston, May 29 and 30, 1914.

Description of Plate.

FIGURE 1. The Metric System of Length, and the Great Electromagnetic Spectrum. The ciphers represent the places in the Arabic system of arithmetical notation. The meter, the unit of measure, is in the units place followed by the decimal point. The ciphers at the right of the decimal point, therefore, represent the places for decimals of a meter; and those at the left represent multiples of a meter. Above the ciphers, the words underscored are the various units of length. The shortest unit of length, the Angstrom unit, is the one usually used to indicate the length of light waves. Below the ciphers the words in large type suggest distances which are of the same order of magnitude as the lengths represented by the ciphers which the words subtend, e. g., known stars are from 1 to 10,000 light-years away (a light-year is the distance light is propagated in one year at the rate of 300,000 kilometers or 186,000 miles per second); microscopical distances are from millimeters to microns in length; colloid particles are from microns to double-microns in diameter; molecules are less than double-microns in diameter; etc. The words, above the ciphers, not underscored, are the names of the various regions of the great electromagnetic spectrum. The names are placed with reference to the scale of measure of lengths so as to indicate the order of magnitude of their respective wave-lengths; e. g., wireless waves are some hundreds of meters long. (The "S. O. S." wireless call is given in waves 300 meters long.) The longest wireless waves ever produced are some number of light seconds long. These waves are probably the longest things man has ever produced. They are still traveling off in space, and are now several light years away. Light waves are 0.1 microns long. Gamma waves, from radio-active substances, have very short wave-lengths. As shown in the figure, one could place 1,000,000 of them end to end in a space only one micron long.

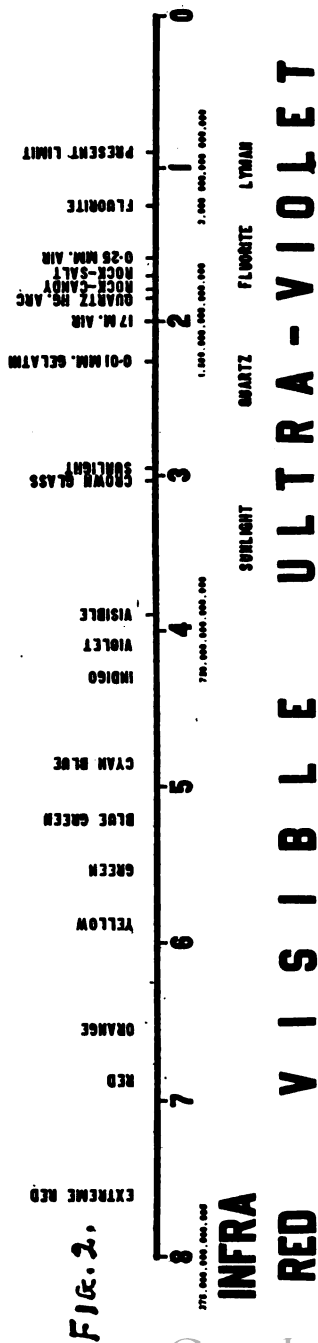
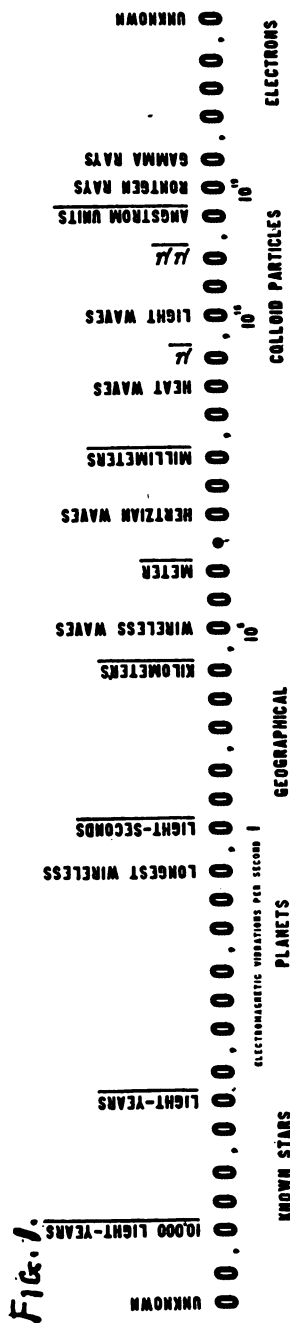
When we are dealing with the biological effects of electromagnetic waves we are concerned with vibration frequency, or the number of electromagnetic vibrations per second. Electromagnetic waves are all propagated through space at the same rate. Hence, the number of vibrations per second varies inversely as the wave-lengths. The number of vibrations per second is indicated by the small figures just beneath the ciphers. An electromagnetic wave one light second long obviously vibrates once per second. A wave 100 meters long vibrates 10^8 or 1,000,000 times per second. Light waves vibrate 10^{15} (1,000,000,000,000,000) or some quadrillion* times, while Röntgen rays vibrate 10^{19} (10,000,000,000,000,000), or some quintillion* times per second. The gamma rays vibrate still faster.

FIGURE 2. The Metric System of Length, Showing one Micron Divided into Tenths. (to save space only 8 of the tenths are shown), and the Light Region of the Great Electromagnetic Spectrum. Any of the ciphers in Figure 1 may be replaced by the digits from one to nine. In Figure 2 the cipher marked light waves, i. e., the cipher which occupies the place for one ten-millionth of a meter, or one-tenth of a micron, has been thus expanded. As will be seen, we obtain a spectrum of wave-lengths which includes part of the infra-red, the visible, and the ultra-violet rays. The colors of the visible spectrum are written above their respective wave-lengths. The ultra-violet region has also been provisionally divided into regions which might be recognized as colors to eyes adapted for seeing ultra-violet rays. For convenience the names of the ultra-violet "colors" are printed below the line of wave-lengths. Sunlight ultra-violet includes the ultra-violet found in sunlight from the end of the visible to about wave-length 3,000 Angstrom units. Quartz ultra-violet includes the ultra-violet light emitted by the quartz mercury-vapor lamp but not found in sunlight; roughly from wave length 3,000 to wave-length 2,000 Angstrom units. Fluorite ultra-violet includes the light which passes through fluorite but not through quartz.

*The names given above are the American names for these numbers. The English names are thousand billion and trillion respectively.

This light was discovered by Schumann and is often referred to as the Schumann ray. The Lyman ultra-violet, the light recently discovered by Theodore Lyman, includes the shortest ultra-violet light waves known.

Above the line in the ultra-violet region are a number of names so placed as to indicate the limits of transparency of the substances named. But few substances are transparent to the extreme ultra-violet rays. The substances named are selected from less than a dozen substances known to be transparent in this region of the ultra-violet. The number of electromagnetic vibrations per second is indicated by the small figures below the line. It will be seen that a doubling of the vibration frequency occurs between wave-lengths 8,000 and 4,000 Angstrom units, giving us the whole visible spectrum from the extreme red to the violet. A second doubling of the vibration frequency occurs in the sunlight and quartz ultra-violet, while there is a third doubling in the fluorite ultra-violet.



ible, and to ultra-violet waves; thin deposits of metallic silver, to ultra-violet waves; thin aluminum plates, to Röntgen waves; and thin metals of all kinds, to gamma waves. No substance is known which is transparent to the entire electromagnetic spectrum.

In general, matter decreases in transparency as the vibration frequency increases from the visible to the extreme ultra-violet, where even highly rarified gases are opaque. As we pass from the ultra-violet region of the spectrum to the Röntgen and gamma regions the conditions are reversed; matter increases in transparency as the vibration frequency increases (the rays harder, more penetrating).

The shortest gamma waves are able to pass through several centimeters of lead.

If the object upon which the wave train falls is capable of resonant vibrations and if the resonant vibrations are not accompanied by friction, the waves are reflected. Usually only waves of certain vibration frequencies are reflected, for example, a red apple reflects red light waves. In the case of good conductors like the metals all of the light is reflected, "metallic reflection," as by a silvered mirror.

If the object upon which the wave train falls is capable of resonant vibration, and if the resonant vibrations are accompanied by friction of some sort, the temperature of the body may be raised or the absorbed energy may bring about chemical changes.

The substances of which living organisms are composed are capable of resonant vibrations for a considerable range of vibration frequency. While practically no studies have been made upon the physiological effects of Hertzian waves, it is known that they are absorbed by the tissues of the body. We do not know what becomes of the absorbed energy. Leaving the Hertzian region of the spectrum, and passing towards the regions of shorter wave-lengths, we find that with the higher vibration frequencies physiological changes become more pronounced. As the name indicates, when the *heat* waves are absorbed by a body, the temperature of the body is raised. It is only necessary to mention the influence of temperature upon life to indicate the

importance to living organisms of the electromagnetic vibrations of the particular wave length which we know as radiant heat.

Life on this earth is equally dependent upon the shorter *light* waves with their still higher vibration frequency. We will consider this region of the spectrum in more detail, but first I should like to call your attention to the fact that the shorter Röntgen and gamma waves also bring about very important physiological changes.

The difference in the physiological effects of the Hertzian, heat, light, Röntgen, and gamma rays is dependent upon the differences in the vibration frequencies of these rays. In the same manner the differences in vibration frequency determine the differences in the physiological effects of the various regions of the light spectrum. The vibration frequency determines the invisibility of the infra-red light, the various colors of visible light, and the power of the ultra-violet light to produce erythema. Now, by a reference to Fig. 2, it will be seen that the vibration frequency changes more rapidly as we pass towards the regions of shorter wave lengths. Hence, the movement of a small distance along the line between 0.4 and 0.2 microns and a still smaller distance between 0.2 and 0.1 microns will have a proportionately large effect upon the nature of the intensity of the physiological changes produced by the light. This is of importance in connection with light in the Tropics, for a slight extension of the solar spectrum into the region of higher vibration frequencies may be of great biological importance. It has been shown by a number of investigators that with constant light intensity, the abiotic action of ultra-violet light increases as the vibration frequency increases. The effect which a slight extension of the solar spectrum might have upon life in the Tropics is shown by the results of the following experiment. The writer tested the killing power of light of various wave-lengths between 3,000 and 2,500 Angstrom units (sunlight ends at about 2,950 Angstrom units). Bacteria and the spores of various fungi were used. It was found that light of wave-lengths shorter than 2,925 Angstrom units would kill by an exposure of 10 minutes, while for wave-lengths longer than 2,925 Angstrom units the organisms were not killed by an exposure of 120 minutes. A

change of wave-length of only 25 Angstrom units was sufficient to cause this great change in the killing power of the light. The writer has found a similar change in the chemical action of ultra-violet light. A solution of egg albumin was exposed to light containing wave-lengths shorter than 3,000 Angstrom units. An exposure of 3 or 4 hours resulted in chemical changes which caused the albumin to coagulate. A similar solution of egg albumin was exposed to ultra-violet light which had passed through a crown glass filter, thus excluding the waves shorter than 3,000 Angstrom units. An exposure of 50 hours resulted in no coagulation. A similar relation between vibration frequency and chemical action has been found with certain amino acids.

The fact that such physiologically important organic compounds show a marked change in photostability at about the place where sunlight ends, has a wider interest than that connected with life in the Tropics. It raises the question of the relation between the ultra-violet limit of the solar spectrum and the possibility of life not only on our own earth, but on other celestial bodies as well. For it seems that life as we know it would not be possible in a world which received shorter electromagnetic waves than those which we receive from our sun.

According to a photochemical law first stated by Talbot, the amount of chemical change produced by light is proportional to the product of the intensity of the light times the length of the exposure, provided the vibration frequency is kept constant. Within certain limits the abiotic action of light follows the same law. Measurements, therefore, on the intensity and the duration of light in the Tropics are very valuable. From a physiological point of view it is important to know the intensity and the duration of the invisible ultra-violet rays, especially those rays which are near the ultra-violet end of the solar spectrum. Unfortunately, the published tables of solar radiation omit just the data for which we have the greatest need.

It is well known that only those electromagnetic waves which are absorbed are effective in bringing about physiological changes. Hence, studies on the power which the various tissues have for absorbing the rays are important. One of the most important discoveries made by Finsen, a discovery which

proved to be the key to his success in phototherapy, was that it is the blood in the skin which absorbs most of the ultra-violet light. Sunlight ultra-violet can penetrate blood-filled skin but a fraction of a millimeter. But if the skin is made anemic by pressing out the blood, bacteria can be killed by ultra-violet light which has passed through 4.25 millimeters of skin. This fact is, I believe, of great biological importance in connection with the question of the pathological effects of an excess of light. The energy of the light absorbed might cause a decomposition of the substances contained in the blood, and the blood stream would become loaded with protein decomposition products.

This subject has scarcely been touched by experimental investigation. It would seem to me to be a most profitable field for study.

There is another phase of the action of light which has great biological interest, a phase which should be more extensively investigated. This is the so-called "photodynamic effect" of fluorescent substances. Vogel in 1873 showed that when certain fluorescent stains are added to the gelatin of a photographic plate, the plate becomes more sensitive to those colors which these stains absorb.

The silver salts used in sensitizing the photographic plate are normally more sensitive in the violet and ultra-violet part of the spectrum than they are in the red and orange part. If, however, a fluorescent stain which absorbs, for example, red light, be added to the plate, the sensitiveness of the silver salt to red light will be increased so that it may equal or even exceed the sensitiveness to violet and ultra-violet light. In other words, red light acts on silver salts plus a fluorescent substance as ultra-violet light does on the silver salts alone. Fluorescent stains are regularly employed in the manufacture of certain orthochromatic plates. It has been found that the stain added must form a very close union (chemical?) with the silver salts, the union must be at least such that the stain is not removed by washing. The fluorescent substance acts as a sensitizer and catalyzes the light reaction for the light-waves which it absorbs. A great many photochemical reactions have been brought about by the use of such catalyzing agents.

In 1900 a Russian, and later in the same year, Tappeiner and Rabb, found that if infusoria are placed in a 1 to 1,000,000 solution of acridin (a fluorescent substance) and the culture placed in the dark, the organisms are not injured, but if the culture is placed in the diffused light of the laboratory the organisms are killed. Tappeiner's results have been confirmed by many independent investigators. Tappeiner lists the following as established facts:

1. The photodynamic substance acts only in the wave-lengths which the fluorescent substance absorbs.
2. Photodynamic substances act on enzymes and all animal cells.
3. Only substances which fluoresce in watery solutions are active as sensitizers.
4. In some cases the photodynamic substance acts on the outside of the organism, in other cases on the inside.
5. The substance must fluoresce, but the amount of action does not vary with the amount of fluorescence.
6. The fluorescent waves are not effective, nor is there a photo-electric effect evident.
7. The fluorescent substance must come in contact with the organism. It seems, therefore, to be due to some action of the electrons.
8. The action of the fluorescent substance is not dependent on the presence of free oxygen.

The importance of these facts is evident. Living tissues and ferments may, by the presence of fluorescent substances, be sensitized so that they are destroyed by an exposure to visible light as though they were exposed to ultra-violet light. In this connection it is interesting to note that physicists have, by improved methods of study, found that fluorescence is a much more common property of substances than was formerly believed, indeed, the search has turned so that now one looks for substances which do not fluoresce. And, moreover, fluorescence is particularly common in the organic compounds formed by living protoplasm. The two best known fluorescent substances are the characteristic coloring materials of the plant and animal kingdoms, chlorophyll and hemoglobin.

It appears as if the ability which plants have of forming carbohydrates from carbon dioxid and water is due to the photodynamic action of the fluorescent chlorophyll. We can form carbohydrates from water and carbon dioxid in the laboratory

by the use of ultra-violet light. In the plant in the presence of the fluorescent chlorophyll, the union is made by red and orange light.¹

In the animal kingdom the most attractive view of the function of the visual purple is that it increases the delicacy of response or irritability of the rods in dim light. In this connection Hertel claims to have shown that nerve tissue does not react to light unless pigment is present.

Tappeiner and his colleagues worked with unicellular organisms. But there is evidence that destructive photodynamic actions can take place in animal tissues. I will give the results reported by several investigators.

Hasselbalch has shown that ultra-violet light of wave-length less than 3,100 Angstrom units causes a decomposition of the red blood corpuscles.

Harzbecker has shown that eosin and pheno-safranin have a photodynamic action on the light hemolysis of red blood corpuscles. He found an action within the corpuscle which does not take place at once. The light hemolysis takes place whether the stain is within the corpuscle or not.

Hannes sensitized red blood corpuscles with iodine and various fluorescent stains, and measured the temperature coefficient of the photodynamic light reaction. He found that the temperature coefficient, like that of light reactions in general, is low, from 1.3 to 1.5.

Hausmann found that the alcoholic extract of etiolated plants contains a fluorescent substance which has a photodynamic effect on the red blood corpuscles. Blood corpuscles were also sensitized by chlorophyll green and hematoporphyrin. He sensitized egg albumin to light by animal gall, bilirubin, urobilin, and hematoporphyrin. He also sensitized red corpuscles by these

1. It is interesting to note that, under the conditions which, according to Arrhenius, must have existed before the carboniferous era, when the carbon of the coal and the rocks was in the atmosphere and when the earth thereby experienced a tropical climate nearly to the poles—under these conditions it has been shown that light waves shorter than red and orange could not have reached the surface of the earth. The plants, therefore, were forced to use a method whereby these rays could be utilized for photosynthesis, and, while we are speculating, it is also interesting to note that hemoglobin which is chemically so similar to chlorophyll and also fluoresces, has the complementary color of chlorophyll. It reflects the red and the orange, precisely those rays which the chlorophyll absorbs. Why?

substances. Later he injected hematoporphyrin into mice. Such injected mice if kept in the dark showed no signs of sickness, but if exposed to the diffused daylight of the laboratory they quickly developed reddening at the tip of the nose and tail, like sunburn, and soon died. Another investigator found that a frog's tongue sensitized with eosin and exposed for seven minutes to yellow light showed changes similar to those produced by ultraviolet light.

Eder has very recently sensitized a photographic plate with hematoporphyrin. He did not get positive results with hemoglobin or hematin, but one is not surprised, for it is quite possible that he did not get the proper union between these substances and the silver salts.

Dryer and a number of other investigators have found that the eating of buckwheat produces a marked photosensitiveness in the skin of certain individuals, and he has succeeded in isolating a fluorescent substance from buckwheat flour.

The list of investigations given above leaves no room for doubt that physiological changes may result from photodynamic light reactions. Our bodies contain many substances which under proper conditions may act as sensitizers. For example, hemoglobin does not sensitize until it has escaped from the corpuscle. But there are many pathological conditions which are attended by hemolysis. Any increase in the photosensitiveness which may attend these conditions may have escaped our notice. Finsen's red light treatment for smallpox is interesting in this connection. Finsen's work has probably not received the credit which it deserves. Ryan, the present director of the Finsen Light Institute, claims to have had uniformly excellent results with the red light treatment for the last 22 years. Ryan emphasizes the rule which Finsen laid down in his early papers: in studying the effects of light upon organisms which have been sensitized by photodynamic substances one must use the same care in excluding light from the controls as is used in the handling of photographic plates. Ryan claims that those who have attempted to repeat Finsen's experiments have not heeded this rule.

Since visible light has a much greater penetrating power

than ultra-violet light, the pathological conditions produced by photodynamic light reactions will probably be more deeply seated than those produced by ultra-violet light.

Summary—The electromagnetic vibrations which constitute the radiant energy which we receive from the sun are important factors of the environment in which protoplasm has evolved. Protoplasm is capable of resonant vibration over the entire range of vibration frequencies of solar radiation; therefore, it can “detect” these vibrations and it is modified by them. We already know much concerning the physiological effects of radiant heat. We know much less concerning the physiological effects of light. Not because the physiological effects of light are of less importance, but because we have only recently become possessed of the proper apparatus and experimental methods.

The physiological effects of light are the result of photochemical reactions. There is a marked increase in the photostability of many (all that have been tested) of the proteins and amino acids as we pass from the sunlight region of the ultra-violet to the regions of higher vibration frequencies which lie beyond. Hence we need to know more concerning the intensity and the duration of tropical light at the ultra-violet end of the solar spectrum.

A large percent of “sunlight” ultra-violet light is absorbed in the blood stream, in which tissue important photochemical changes may take place.

Visible light may have an effect on sensitized tissues as destructive as that of ultra-violet light on normal tissues.

SPARGANUM MANSONI. FIRST REPORTED AMERICAN CASE.*

Found in a Breast Tumor at Operation.

By

JOHN T. MOORE, A. M., M. D.,
Houston, Texas.

The larval cestode which I desire to present to this society was discovered in a mass, or tumor, removed from a patient operated upon by me December 1, 1911. The patient was referred to me by Dr. W. W. Greenwood of Plantersville, Texas.

The specimen was submitted to Mr. B. H. Ransom of the Bureau of Animal Industry of the U. S. Department of Agriculture for determination. The parasite, he said, corresponds more nearly to *Sparganum mansonii* than to any other recorded parasite of man. If this be true, then the case may be said surely to have arisen in the United States, as the patient had never been without her borders.

I desire here to acknowledge by deep appreciation of the services rendered me by Mr. Ransom in identifying the worm and for looking up the complete literature of the subject.

I also wish to express my thanks to my associate, Dr. M. A. Wood, for her assistance in the preparation and examination of the tissues.

Case—Male, *act* 47, married, no children, occupation that of a barber.

The patient was born in Calhoun County, Florida, in 1864, and moved to Montgomery County, Texas, when twelve years of age. Lived three miles from the river in Florida, but about twenty miles from a stream in Magnolia, Texas.

Has used shallow well water both in Florida and in Texas. He seldom ate fish and raw vegetables, but was fond of fruits and sweet foods.

When twenty years of age he began to have bloating of the stomach.

Diarrhea and constipation would alternate. He had no vomiting nor pain, except headaches. When first taken sick had fever but none later. Was sick for two years, and was in bed for one year. He lost much weight and became very weak. His sickness was diagnosed malaria.

*Read by title at the Eleventh Annual Meeting of the American Society of Tropical Medicine held in Boston, Mass., May 29 and 30, 1914.

Two months after his sickness began, there appeared a mass, about the size of a small hen's egg, at the margin of the ribs just to the left of the sternum. This mass was tender to pressure and gave pain when patient stooped over. There was no redness, nothing was done to it, and it disappeared after about one year. There remained at this point some tenderness.

Says he has had stomach trouble for a number of years.

Three years ago, a small ischio-rectal abscess developed. This was opened up and was six to eight months in getting well. His weight ran down to 119 pounds. It is now 130 pounds.

Last summer he noticed a mass in the left breast. This gave him no pain. Just below and to the outer side of the nipple was another, though a smaller mass, which was distinctly tender to touch.

He complains of a dull pain along the left costal margin, and occasionally has sharp needlelike pains. These pains he claims have been present since his sickness in 1891.

Examination shows a rather thin man, somewhat pale, and his complexion of a muddy cast.

The following abnormalities were noted: Just beneath or rather lying behind the nipple, there is a somewhat firm mass the size of a small hen's egg. One cannot be certain whether it is in the muscle or lying between the nipple and the muscle. There is a second but smaller mass just below and to the outer side of the nipple. The glands of the axilla are distinctly palpable. The abdomen reveals nothing except a marked tenderness over the appendix and in the gall-bladder region.

An operation was advised for the removal of the appendix and also for the removal of these masses which it was thought were cancerous.

Operation December 5, 1911. The patient was given ether and a radical operation was done, removing the breast, the pectoralis major muscle, and the glands of the axilla.

The abdomen was now opened and some dense adhesions between the gall-bladder and the omentum were freed. The gall-bladder, appearing to be otherwise healthy, was not drained. The appendix was in a normal location, somewhat thickened—a catarrhal type of appendix.

The lymph glands along the mesentery of the sigmoid flexure of the colon were enlarged. These were thought to be enlarged

from the previous ischio-rectal abscess, and were possibly tubercular.

The stomach and the other organs appeared to be normal.

Description of the Specimen.

I. The Breast and Muscle. (a) Macroscopical.—The specimen consists of an elliptical piece of skin, 12 by 6 cm. in area, a section of the pectoralis major muscle and fatty tissue containing a few small lymph nodes.

The pectoralis major muscle on palpation revealed a mass which was behind, to the right and a little above the nipple. This mass seemed to be 2-4 cm. in diameter. A section through the mass disclosed a white tapelike parasite, coiled directly in and between the muscle fibers (fasciculi). This parasite showed distinct and rather active movements, and will be described more in detail a little further on.

There was no definite cyst wall apparent. The irregular cavities or crevices in the muscle which were occupied by the worm showed a dark granular appearance. There was no increased resistance upon sectioning the same.

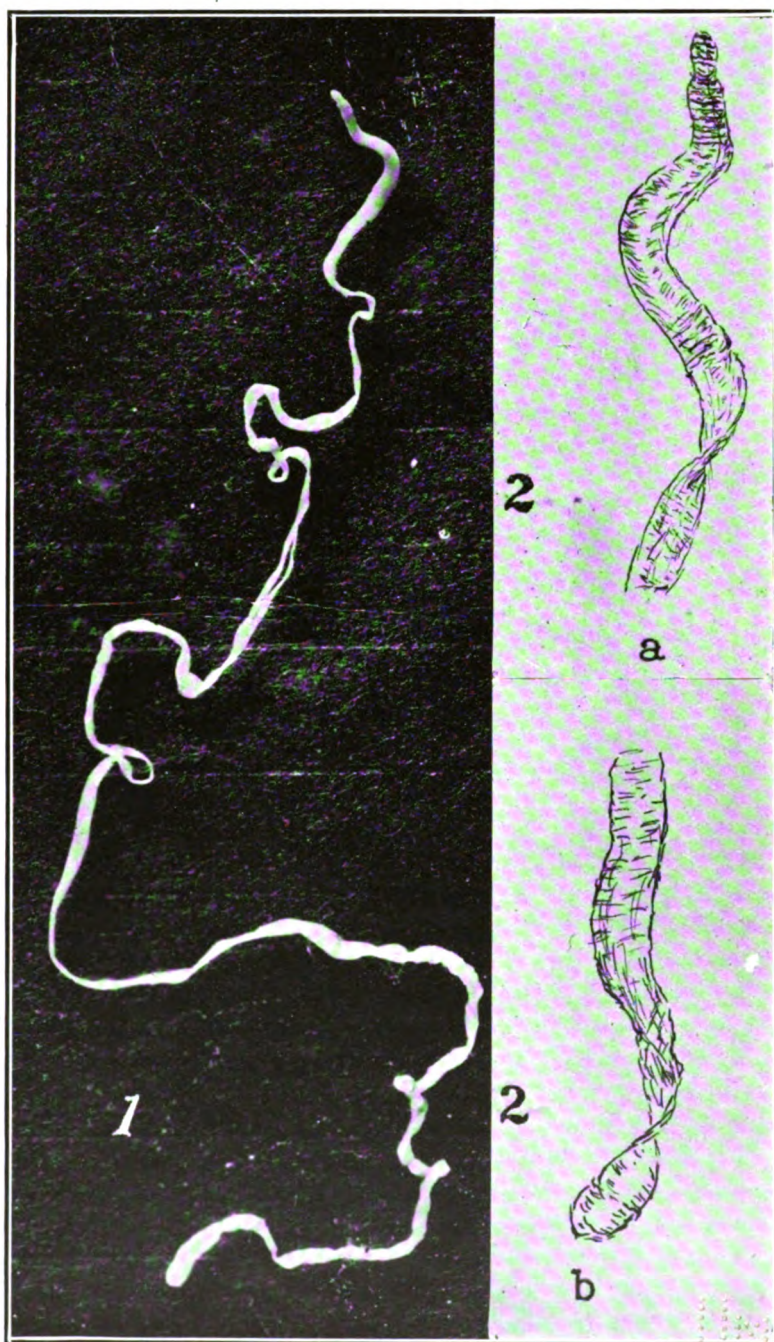
The smaller mass referred to above and felt lying directly beneath the nipple, showed upon section that it was only dense fibrous tissue.

(b) Microscopical.—The muscle tissue at the site of the worm shows many breaks in continuity, both longitudinally and transversely. These spaces are filled with eosinophiles and endothelial leucocytes. There are some bits of muscle tissue that are entirely enclosed by this cellular infiltration, and these show varying degrees of degeneration.

2. The Worm.—As referred to above, section of the mass in the muscle revealed a white thread or tapelike worm which was entangled through the muscle fasciculi.

The worm was removed, with some difficulty, by carefully cutting through the intervening bands of muscle tissue so as not to harm the parasite. The worm during all of this time showed considerable activity.

The part which was taken to be the head end was much more active in its movements than the other part of the worm. These



SPARGANUM MANSONI

Fig. 1—Photograph of parasite. The lines were drawn $\frac{1}{4}$ in. apart, hence photo is twice the size of the worm.

Fig. 2—Pen drawings—a, the head end; b, the tail end (about 6 x natural size.)

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movements consisted of frequent extensions and contractions, or possibly one would better say, the movement was of a peristaltic character. When at rest the worm measured 21.5 cm. in length, and the breadth varied somewhat according to the worm's movements. The head end for about 4 cm. was rounder than the other part, which was flat or tapelike. Upon close examination one is able to make out cross lines in the anterior end, and the other part gives one the suggestion of segments like that of a tapeworm, but I would say there are no segments. There is a delicate line running from the head end backward, but this I was not able to trace farther than 4-6 cm. from the head end.

The photograph (Fig. 1) shows very well the head end is rounder and somewhat thicker than the body part, which is flat or tapelike. There is also seen the projection of a smaller part which would retract and become somewhat hidden during the activity of the worm.

The cross lines, which are seen at some places, seem to depend upon how the worm became fixed in the formalin solution, i. e., whether the parts were in contraction or extension.

I also present some pen and ink drawings made by using a lens, magnifying the specimen about four times (see Fig. 2. a and b).

Subsequent Report of Case.

In December, 1912, just about one year after the operation, the patient returned in a rather bad condition of health. He said that following the operation he steadily improved until he was able to eat well, felt well and weighed 136 pounds. He continued well until the summer came, when he was troubled with constipation and seemed to be very much run down. He continued to feel worse, and in a week or so after getting sick, the constipation was followed by diarrhea. There was much gas and pain in the bowels, redness of the mouth and tongue. He had burning in the palms of the hands, but no eruption on the hands or feet. He was nauseated at times and suffered much pain in the stomach and abdomen, especially after taking food. Sleeps poorly. Has to be up often on account of the diarrhea. Is very thin and the skin is distinctly sallow.

Examination of the stools showed no ova of parasites, nor were there any amœbæ. Occult blood was shown in the stools.

A few acid-fast bacilli were demonstrated in the stool, which were thought to be tubercle bacilli.

The urine and the blood showed nothing pathological.

A diagnosis was made of intestinal tuberculosis, or pellagra, or possibly an association of the two diseases.

He grew worse and died about three weeks after being again seen by me, as I learned after my return from Europe.

I regret exceedingly that no post mortem was held, as could have been done had I been at home at the time.

A note from the physician who attended him at the time of his death states that he had a very sore and intensely red condition of the mouth, just as is often present in pellagra.

Historical.

This very interesting parasite was discovered by Manson¹ in 1882, and was classified by Cobbold as *Ligula mansonii*. The specimens, number 12, were taken from a native of Amoy, China. Leukhart later proposed the name of *Bothrioccephalus liguloides*.

Stiles and Tayler² say that, although the name of *Sparganum*, which was suggested by Diesing, is not generally used, it would be well to adopt the specific name of *Sparganum mansonii*, pending its more scientific classification. In addition to giving a thorough discussion concerning its classification, they give a complete bibliography and a synopsis of the cases reported up to 1902.

They collected 10 cases, all of which were from Japan and China. These authors called attention to the possibility of its being found in American troops returning from China and the Philippines. Their paper gives short case reports of all the published cases according to the authors.

In 1904 Miyake³ published a group of 19 cases by others, and reported two new cases. His paper is most interesting and complete, giving the morphology of this parasite in great detail.

Sambon⁴ in 1907 described two new species which were found affecting man. He proposed for these the name of *Sparganum baxteri* and *Schistosoma mansonii*. The specimen which he called

Sparganum baxteri was found in the thigh of a Masai from German East Africa. This was thought sufficiently similar to be classed with *Sparganum mansoni*, as the same species.

Römer⁵ records a case in 1909. This specimen was washed from the bladder of an officer in the Dutch navy.

Daniels⁶ in 1910, states that he found a large sparganum in a native of British Guiana, but this is by some regarded as a new species, as it was much larger than the usual cestode of this name.

Raillett and Henry,⁷ 1911, reported finding this parasite in a hog in Annam. Their description tallies well with the description of Manson's specimen.

Von Ratz,⁸ in 1913, found some larval cestodes in a pig, and called them *Sparganum railletti*, after the specimen described by Raillett and Henry as referred to above. Other authors seem to think these similar to *Sparganum mansoni*, or at least are very closely related, and called them *Sparganum mansoni*. These larval forms were fed to a dog, and a tapeworm was recovered, which was thought to be the adult form of the parasite. I have not been able to get the description of this specimen, if the case was published.

This briefly brings the subject up to the present time, and I have tried to present all of the reported cases in a table for reference. (See Table.)

Habitat.

As referred to before, the host of this parasite is not known. The adult form has not been found either in the lower animals nor in man, unless it be the one case reported by Ratz, where the larval forms were fed to a dog and an adult tapeworm was recovered.

Stiles and Tayler regard its presence in man accidental and abnormal, and are inclined to think it enters man by the food or drink.

This cestode has also been found in the monkey and jackal.

The parasite is found in the tissues of the body in different localities, having shown a tendency to wander from one location to another.

Seat of the Worm.

Seven of the cases, 1 to 7 inclusive, and 22, were from the urinary passage, or from the tissues about the kidneys. Six cases showed a predilection for the eye, or the tissues of the orbit. They were cases 8 to 11 inclusive, and case 21.

Four cases, 1, 14, 17, and 25 (my own cases), were in the pectoral region.

Six cases, 13, 15, 18, 19, 20, and 23, were from the quadriceps femoris, or the thigh.

One case, 24, was from the connective tissue of the posterior mediastinum.

Case 16 was from the connective tissue of the anterior abdominal wall.

Geographical Distribution.

The countries furnishing the cases are: Japan 20, China 2, German East Africa 1, British India 1, United States of America 1.

Symptoms.—It will be observed that pain in the locality at which the larva presents itself is the most constant symptom. Painful swellings in various parts of the body of an intermittent or transitory character ought to direct attention to the possibility of this larva.

The parasite seems to locate itself often in the genito-urinary apparatus. Painful urination being a common symptom. Cystoscopy would reveal the presence of the worm in the urinary bladder.

Several of the cases gave severe pain, with swelling and redness in the region of the eye, or in the conjunctiva. Swelling, with pain in the breast, was prominent as a symptom in my case.

There is nothing characteristic of this parasite in the swelling and redness of the muscle. Incision into these migratory swellings should be made, to disprove the presence of this cestode.

There ought to be an eosinophilia in these cases. I could find no blood record in my case.

Treatment.

No steps can be intelligently taken to prevent the parasite being introduced into the body, because the host is not known.

The treatment is entirely mechanical or surgical. Where the worm presents itself and can be carefully extracted the tissues heal readily. Incision into the swelling may be necessary when the parasite may be withdrawn without destroying much tissue.

In my case I removed more tissue than was necessary, under the impression that I was dealing with cancer of the breast.

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TABLE OF CASES OF SPARGANUM MANSONI HITHERTO REPORTED.

AUTHORITY	AGE SEX	COUNTRY	SITUATION OF THE WORM	SYMPTOMS	DIAGNOSIS	THE COURSE	OCCURRENCE OF A HOUSE CYST	LENGTH AND BREADTH OF WORM	REMARKS
1. Manson	34 male	Amy, China	One in right breast, 11 in perirenal tis- sues	Tenesmus while urinating Spreading pains in urethra and bladder	Accidentally discovered during dis- section			12-14 inch	Twelve objects found in dis- secting a man who had died of dysentery and stricture
2. Scheube	28 hostler	Kioto	Lost while urinating	Tenesmus while urinating Urine comes in drops		Unknown be- cause patient was put into prison		18.5 cm. Alive, 30 cm. long. Prep. in alcohol 8 cm.	A piece torn off and left in- side *
3. Namba (Descr. by Iijima and Murata)	Boy age unknown 9?	Province Eschigo	Lost while urinating	Tenesmus while urinating Sometimes itch- ing and pressure of the perirenal		Cured		Fresh 2 feet long, 1.5 mm. wide	
4. Sharto (Descr. by Iijima and Murata)	Peasant 25	Near Kioto	Lost while urinating	Slight haematuria		Cured		Fresh 36.4 cm. Prep. in alco. 10.5 cm. long Fresh 1.2 cm. Prep. 6.5 cm. in width	
5. Toyoda (Descr. by Iijima and Murata)	Male 42	Osaka	Lost while urinating	No previous symp- toms, only tenes- mus when worm appeared		Cured		Length 10 cm. width 0.5 cm. Prep. in alco.	
6. Nishimura	Male 28	Near Kioto	Lost while urinating			Cured			

7. Kojima and Itakura	Male 33	Province Mikawa	Lost while urinating	Only itching sensation	Cured	Length 14 cm. width 0.2 cm. Fresh	Three years previous a similar worm came while urinating. At that time pain and hæmaturia. After coming of the worm prompt cure effected
8. Sato (Descr. by Iijima and Murata)	Boy 17	Kanazawa in Koga	From corner of left eye, spontaneously	Spontaneously from corner of left eye, then ex-tracted. Slight conjunctivitis	Cured	Length 25 cm. width 1.5-4 mm. Prep. in alcohol	
9. Shingu (Descr. by Iijima and Murata)	Girl 15	Near Kioto	Spontaneously from rt. eye between conj. Bulbi and Sclera		Cured	Length 12 cm. width 0.3-0.6 cm. Prep. in alcohol	
10. Takahashi and Hagiwara (Descr. by Iijima and Murata)	Girl 11	Province Kuske	Between conj. Bulbi and Sclera. Removed by incision	Bean size tumor. Attacks of pain	Cured	Length 2.5 cm. width 0.2 cm. Prep. in alco.	
11. Imai	Peasant 33	Near Osaka	In retrobulbi part near optic nerve	Attacks of pain. Slight exophthalmus	Cured	Length 30 cm. width 0.2-0.3 cm. Fresh	
12. Miyake	Man 20	Osaka	Spontaneously from the conjunctiva	Pains, chemosis	Cured	Length 12 cm. width 0.3 cm. Fresh	
13. Nagao (Descr. by Iijima and Murata)	Soldier 21	Province of Echū	Subcutaneously in the thigh	Temporary pains	Cured	Length 8.5 cm. width 3.5-6.5 cm. In alco.	
14. Inoue	Man 47	Near Osaka	In the right breast	Piercing, dull pains. Elastic hard tumor	Cured	Length 34 cm. width 0.4 cm. Fresh	

TABLE OF CASES OF SPARGANUM MANSONI HITHERTO REPORTED—Continued.

AUTHORITY	AGE SEX	COUNTRY	SITUATION OF THE WORM	SYMPTOMS	DIAGNOSIS	THE COURSE	OCCURRENCE OF A HOUSE CYST	LENGTH AND BREADTH OF WORM	REMARKS
15. Shakurane	Male 43		In quadriceps femoris muscle	Attacks of dull pain. Abscess		Cured	Only simple fissure in muscle pre- sent	Length 34 cm. width 0.5 cm. Fresh	Worm was put in salt sol. at body temper- ature. Next day was dis- solved into flaky sub- stance
16. Diase			In subcutane- ous connec- tive tissue of abd. wall					Length 1 foot. Fresh	
17. Shawabe	27 Sex not specified	Wakayawa Province of Kischu	Hard tumor without in- flammatory signs, sensi- tive to pres- sure in Pec- toralis maj. muscle. Ir- reg. fissure.	Tumor size of child's hand, fluctuating, no inflammatory signs. Under half of Scar- pa's Triangle	Unknown tumor	Cured	Cyst wall com- posed of hard connective tissue with smooth inner surface	Length 18.5 cm. breadth 0.3-0.4 cm. Fresh	Had tumor since 12 years old
18. Omi 1. Fall	Male 42	Kioto	Connective tis- sue of upper thigh	Soft, fluctuating tumor, size of child's fist, slightly sensi- tive to pressure	Diagnosed in course of op- eration	Cured	Large fissure where worm was located. Membrane thickened	Length 45 cm. Breadth 0.3 cm. Fresh	Kept in watery fluid temper- ature of body. Swelled—3d day dis- solved
19. Omi 2. Fall	Male 26	In vicinity of Kioto	Connective tis- sue of upper thigh		Diagnosed in course of op- eration	Cured	No special cyst wall seen	Length 20 cm. Fresh.	

20. Miyake.....	Man 43	Osaka	Upper left thigh	Pain and swelling in left knee joint and upper part of left thigh 2 days later	Abscess	No special cyst formation, only simple opening of the tissues	Length 35 cm. width 3-5 mm.	Destroyed by too high temperature in incubator
21. Miyake.....	Male 26	Osaka	Between lower lid and bulb of right eye	Pain and swelling in right eye		No special cyst formation	Length 16 cm. plus width 0.2-0.3 cm.	Several pieces of worm were rubbed out of eye before incision was made and worm removed.
22. Von Roemer.....	Male	Officer in Dutch Navy	Washed out of bladder	Inflammation of the bladder				About 1 month previous to passing of worm, the patient had a collapse when playing tennis.
23. Sambon.....	Male (Masai)	German E. Africa	In the thigh	Abscess on thigh			Length 4 cm. width 3 mm.	Cold perpiration, pale, intense pain in abdomen over bladder, strong vomiting, no diarrhoea
24. Daniels.....	Male (Native)	British Guiana	In connective tissue in the posterior mediastinum				Length 15 cm. width 1 mm.	
25. Moore.....	Male 46	U. S. A.	Pectoralis major muscle behind left breast	Painful swelling in breast. Tender to pressure	Found when tumor was removed	No cyst, only space where in worm was entwined	Length 8 inches	Had previously suffered from pain and swelling at left costal margin

CLINICAL NOTES.

Treatment of Ground-Itch.

By

N. BARLOW, M. D.,
Guyamel, Spanish Honduras.

Since the report in the *Journal of Tropical Diseases and Preventive Medicine* upon the fetid interdigital ulcer, a number of these cases have been treated in this hospital, of which fully one-half have had their port of entry in a previous ground-itch. It was soon noticed that the uncinarial dermatitis was relieved more promptly by this treatment than by iodine, permanganate, or any of the ointments and lotions used. The treatment consists in the application of a solution of salicylic acid, 3%, in ethyl alcohol. Pledgets of cotton are soaked in the solution, applied to the affected areas, and left in place 5 minutes. The treatment is repeated twice daily.

Cases of ground-itch uncomplicated with secondary infection are relieved immediately, and entirely cured in from two to four days.

A Case of *Uta Venomosa*.

Reported by

W. F. BAILEY, M. D.,
Cerro de Paseo, Peru.

History of Case.—Male, 43 years of age. Two years ago, while in the interior of Peru, this man was bitten by a small fly, which the Indians call "*Uta venomosa*" (or poisonous fly), a little, white, fuzzy thing no larger than a pin head. When it bites, the next day a very small blister appears, with a watery discharge. This man was bitten just above the right eye. That eye was eaten away, also his nose; his right hand is in the same condition, as well as his right foot; his face is a mass of pus, underneath. The flesh is a bright pink. There is no pain, but a very disagreeable odor.

This disease is found only in Huancisco, Peru, and 45 leagues from there to the interior. When the Indians are bitten they apply gunpowder on the bite and set fire to it, with very good results. This is the only case of a white man ever known as having this disease in Peru.



ILLUSTRATING DR. BAILEY'S CASE OF UTA.

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THE AMERICAN SOCIETY OF TROPICAL MEDICINE.

1915 Meeting.

The twelfth annual meeting of the American Society of Tropical Medicine will be held in San Francisco, Cal., Monday, Tuesday, and Wednesday, June 14, 15, and 16, 1915.

The Secretary will be glad to receive, at your earliest convenience, an indication of your intention to attend the meeting. He will also be glad to receive the title of a paper which you will read. If you are unable to attend the meeting, the Council will be glad to have you send a paper which may be read either by title or by proxy, and published exclusively in the *American Journal of Tropical Diseases and Preventive Medicine*. A prompt reply will be appreciated.

Very truly,

JOHN M. SWAN, Secretary.

457 Park Avenue, Rochester, New York.

NEWS AND COMMENT

The New York Department of Health has appointed Dr. Alvah H. Doty consulting expert on communicable diseases.

Dr. E. E. Trotter, United States Public Health Service, has left Washington, D. C., and is now stationed in Honolulu.

Out of 188,411,876 passengers carried on all lines of the Pennsylvania Railroad system during the last year, not one was killed.

Winston-Salem, North Carolina, will organize a complete health department, with a full-time health officer at its head.

A monthly bulletin has been commenced by the Quebec Municipal Board of Hygiene and Statistics. It will be published in English and French.

A North Dakota Public Health Conference was organized on December 18, with health officers and others interested in public health as members.

A new order provides for a surgeon of the United States Public Health Service on every revenue cutter cruising on the Atlantic Coast during the winter.

Dr. Richard H. Harte, Director of Public Health and Charities of Philadelphia, resigned on January 6, and Dr. S. Lewis Ziegler has been appointed to succeed him.

The moving pictures prepared by the New York State Department of Health for the Panama-Pacific Exposition will be shown throughout the State before they are sent to California.

Dr. Edward Hindle, author of "Blood-Sucking Flies and Disease," reviewed in this number, is at present a commissioned officer on the firing line with the British Engineer Corps in France.

The State Hygienic Laboratory of the University of Nevada, Reno, will perform the complement fixation test for syphilis free of charge for any citizen of the State requesting it.

The Interborough Rapid Transit Company of New York will discontinue the use of disinfectants in the elevated and subway cars and will depend upon frequent scrubbing and airing for disinfection.

On January 11, twenty-four restaurants were opened in public schools of New York City. A portion of any item on the menu is served for one cent and tickets are given those children who cannot pay.

At the urgent request of the women's clubs and other organizations in Kansas, the Governor will ask the Legislature to provide for a bureau of child hygiene in connection with the State Board of Health.

The campaign carried on against cholera and cholera carriers in the Philippines has proven successful, for the epidemic is practically over, only a few sporadic cases having been reported recently.

Dr. Bahr, who recently completed the revision of Manson's "Tropical Diseases," is now superintendent of the Seamen's Hospital, which is operated in conjunction with the London School of Tropical Medicine.

The El Paso County (Colorado) commissioners have appointed a medical board consisting of six specialists along different lines to take the place of the county physician, Dr. James H. Brown, who recently resigned.

The mosquito work of the Philippine Islands, formerly carried on by municipal authorities, has been turned over to the Bureau of Health and will be in charge of Dr. C. S. Banks, U. S. Bureau of Agriculture.

A health campaign has been carried on in Lawrence County, Alabama, during December. Lectures were given on typhoid, pellagra and hookworm, with free examination for and treatment of the last named, of which many took advantage.

Mr. George Warren, who offered himself to be bitten by malarial mosquitoes in the classical experiments of Manson, Sambon and Low, is at the present time research assistant under Dr. Newham at the London School of Tropical Medicine.

Professor Bacot, medical entomologist of Lister Institute, is now at Freetown, Sierra Leone, where he has been directed by the Royal Society to investigate the relation of *Aedes* mosquitoes to yellow fever with especial reference to etiology.

Dr. William H. Park has resigned as Dean of New York University and Bellevue Hospital Medical College in order to devote his entire time to his duties as Director of the Laboratories of the Department of Health of New York.

The Indiana Federation of Clubs has requested the Legislature to pass a law making special training for health officers compulsory. They also desire that all officers devote their whole time to their offices and be placed under civil service rules.

Dr. Aldo Castellani, for a number of years in charge of the Clinic for Tropical Diseases of Colombo, has accepted the chair of Tropical Medicine at the University of Naples and the directorship of the Royal Clinique for Tropical Diseases in the same city.

The Public Health Service has issued a detailed list of the thirty cases of plague in New Orleans from June to December, 1914. A statement is also made concerning the infected rats caught during that time. No case of human plague has occurred in the city since September 30.

On account of his twenty years of service at Harvard University and the severance of his connections with the University, a memorial will be erected to Dr. Theobald Smith. The memorial will probably take the form of a bas-relief of Dr. Smith, to be placed in the Medical School.

Colonel Alcock, arthropodologist of the London School of Tropical Medicine, accompanied by his assistant, Dr. O'Conner, returned a short time ago from an expedition to West Ireland to investigate the relation of *Chrysops* flies in parasitism to animal and human life in that region.

The 11th of December was observed as health day in the schools of Greenville County, South Carolina. The schools and their surroundings were put in sanitary order, compositions on public health were read by the children, and lectures given by physicians on public and personal hygiene.

Tulane University of Louisiana has been granted a charter for the establishment of a chapter of the Alpha Omega Alpha Fraternity. This is an honorary medical fraternity existing in the leading colleges of the United States and Canada. The Tulane chapter will be known as the Alpha chapter of Louisiana.

The following officers were elected at the last meeting of the Porto Rican Medical Association at San Juan: Dr. Pedro Gutiérrez Igaravidez, San Juan, president; Dr. M. de la Pila Iglesias, Ponce, vice president; Dr. José S. Belaval, San Juan, secretary, and Dr. Jacinto Avilés, San Juan, treasurer.

The physicians of Macomb, Illinois, are attempting to work on a coöperative plan and to that end have rented a portion of an office building. The instruments and knowledge of each will be at the disposal of the others, and patients may receive the advice and consultation of all without additional cost.

In Davenport, Iowa, a case of smallpox developed in a family and the young man was removed to the isolation hospital. The authorities urged vaccination for the rest of the family, but it was refused. Within a week the house was placed under strict

quarantine, as five other members of the family had developed smallpox.

The State Legislature will be requested by the Minnesota State Medical Society to set aside 10,000 acres for the establishment of a leper colony. Approximately fifty persons in the State are known to be suffering from leprosy. It is also proposed to establish a branch hospital at the State University for clinical purposes.

With the purpose of teaching the people the real cause of disease and the prevention of mental diseases, the Massachusetts Society of Mental Hygiene has been organized. Hon. Harvey H. Baker, Boston, is president; Dr. Charles E. Thompson, Gardner, secretary; Dr. John Keran, Boston, treasurer, and Dr. Frankwood E. Williams, Boston, executive secretary.

The Tennessee State Board of Health has found it difficult to carry on the hookworm work started by the Rockefeller Sanitary Commission and for a time it seemed probable that it would have to be suspended. The International Health Commission has therefore undertaken to assist in the work until July, 1915, when it is hoped that the State will have found the means to continue it.

The facilities of the new Wellcome Medical Research Laboratory in London have been offered to the Government for the preparation of vaccins and serums for the use of the British Army. Dr. Balfour, formerly of Khartoum, is the director; Dr. Wenyon, recently of the School of Tropical Medicine, is protozoologist and assistant director, and Dr. Sambon, also of the Tropical School, is the present epidemiologist.

Improvements are to be made in the Louisiana Leper Home, for which a contract of \$39,560 has been let. Two new cottages, a clinical building and a power house will be built and electric light, cold storage, refrigerator plant and system of sewerage, drainage and plumbing will be installed. The Leper Home has recently been put into closer communication with the outside world by the installation of telephones in the Home.

A course of instruction for physicians who desire to become county or city health officers is proposed by the North Carolina State Board of Health. The course as outlined includes four weeks in the executive offices where details will be studied; four weeks in vital statistics; three weeks of sanitary instruction; four weeks at State Tuberculosis Sanatorium; four weeks in the Hygienic Laboratory, and six weeks of actual work under one of the field workers.

A new sanitary code has been adopted by the Public Health Council of the New York State Department of Health, which will become effective March 1. Violation of any of these laws will be considered a misdemeanor and will be punished the same as a law made by the Legislature. Among the regulations of the code are the abolition of the common drinking cup, the common towel, the unclean barber cup and the prevention of spitting on the streets and in public buildings.

The Cutter Lectures in Preventive Medicine will be given this year at the Harvard Medical School by Dr. Joseph Goldberger, United States Public Health Service, on April 2, who will have for his subject "Diet and Pellagra," and by Dr. Victor C. Vaughn, Professor of Hygiene and Physiologic Chemistry and Dean of the School of Medicine and Surgery of the University of Michigan. The lectures of Dr. Vaughn will be given on April 14, 15, and 16, and the subject will be "The Phenomena of Infection."

The Missouri Foundation for Health Conservation has been incorporated in that State, whose objects are "the conservation of health and the prevention of disease to the end that human efficiency may be increased and human suffering prevented." A laboratory will be established in St. Joseph where physicians living in that city and contributory districts may send specimens for examination. Other plans will soon be made and inaugurated. Dr. Daniel Morton, St. Joseph, is secretary of the foundation.

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Prominent physicians in New York have formed a committee to urge Congress to revoke the war tax on tooth wash and powder, in the belief that the advances made in mouth hygiene will be given a severe backset by such a tax. The members of the committee are: Dr. Herbert L. Wheeler, chairman; Drs. Francis Delafield, Thomas Darlington, S. S. Goldwater, Ernest Lederle, H. Holbrook Curtis, William S. Bainbridge, William Carr, O. Victor Limerick, Victor Hugo Jackson, William C. Deane, Herbert D. Pease, Frank E. Miller, Edmund Prince Fowler, and William Gies.

A medal has been established by the Medical Reserve Corps, United States Army, New York Division, in honor of Surgeon General William C. Gorgas, and will be given annually and known as the Gorgas Medal. Any member of the Medical Corps, United States Army, the Medical Reserve Corps, United States Army, and the medical corps of the organized militia, may compete on any medico-military subject. Three members of the faculty of the Army Medical School have been appointed a board of officers and they will set the time and receive and pass on all papers submitted. They are Colonel Charles Richard, Lieut.-Col. Champe C. McCulloch, Jr., and Major Eugene R. Whitmore, Army Medical Corps.

Public Health Activity.

KANSAS.—Bulletin of the Board of Health, December, 1914. The Kansas Board of Health has adopted the almanac form of bulletin for 1915. The historical events are given chronologically and interspersed among them are pertinent suggestions for good health. On the opposite side from the calendar pages, such topics as consumption, cancer, school hygiene, the sanitary privy, flies and mosquitoes, and others are discussed. The bulletin is interesting and should be of much practical use as well as pleasure to all who read it.

NEW YORK.—Buffalo Sanitary Bulletin, November 30, 1914. The Tenement House Number of this bulletin lays before the eyes most graphically the filth, disease and immorality due to

the overcrowding of tenements. In the Polish section of the city one of the hardest things to regulate is the keeping of lodgers. Though the law requires 400 cubic feet of air space for each person, it is often found that there is actually not more than 150 or 200 cubic feet. In order to ascertain the true number of occupants of the rooms of these buildings, they would have to be visited at night, and this is a task the inspectors are not at present able to assume. When one knows that there are 4000 tenement houses and several thousand rooming houses in Buffalo, one can realize the gigantic task of inspection and reinspection. "Every room in such houses must be accurately measured to determine the air space therein, and to ascertain the number of occupants in each room or apartment. The names of each family must be obtained and recorded. The entire building from cellar to attic must be carefully inspected to ascertain the number of water closets, light and dark rooms, public halls and stairways, water supply, garbage receptacles, handrails on stairs, and the general condition of the building in regard to repairs, cleanliness of walls and ceilings. The roof and conductor pipes, together with the yard and courts, must be seen by the inspector in order to make an intelligent report of the premises." Such inspections are constantly being made, but the conditions are still far from ideal. Only by education, example, legislation, laws and enforcement, and principally by coöperation of the entire public, can these conditions be improved and perfected.

WISCONSIN.—State Board of Health Bulletin, July-September, 1914. Thousands of lives are lost in the battles of the war going on at present and the world holds up its hands in horror. At the same time there goes on almost unnoticed the thousands of deaths of helpless little babies. Between the years 1900 and 1910, there were 2,500,000 deaths of babies under one year of age in the United States. This is equivalent to the wiping out every 10 years of a population as large as that of New Jersey, greater than that of Alabama, California, Iowa, Kentucky, Minnesota or Wisconsin, and equal to the combined population of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada.

CURRENT LITERATURE

PRELIMINARY WORK TOWARD THE ERADICATION OF TUBERCULOSIS IN THE GERMAN EAST AFRICAN PROTECTORATE.—(*Archiv fur Schiffs-und Tropen-Hygiene*, Bd. 18, No. 21, 1914.) P. Mantefel finds that the number of cases among the natives is on the increase from year to year. In the year 1912-13 there were 140 cases. Tuberculosis generally shows itself in the form of lung and laryngeal infections, and miliary tuberculosis is rare. Rare, if at all, are also the cases with infection due to the *B. tuberculosis bovis*, nor can it be said with any great degree of certainty that these supposed cases are really due to the bovine type, especially as tuberculosis among the domestic animals has not been positively established. The author concludes that the source of the infection is to be found in those natives suffering from advanced lung and laryngeal lesions. He thinks that the East Indians and Goanese, as well as individuals of other nationalities, were originally responsible for the spread of the disease, while Portuguese, Arabs, Germans, Greeks, etc., coming into the land keep up the disease. Sudanese, Nubians and other tribes have undoubtedly brought it from the north. The cutaneous reaction of Pirquet has been found positive in 7 per cent of those affected with leprosy and in 70 per cent of those where the bacilli could be demonstrated microscopically. Of 183 native children 14 to 15 years old, 25.6 per cent, and of 388 adults 22.4 per cent were found positive. It is suggested that tuberculosis be considered and treated as a public danger and that all those in advanced stages should be isolated in suitable houses, or villages. Natives react fairly well to old tuberculin and encouraging results have been obtained; the natives, however, refuse further treatment as soon as there are signs of improvement, and the treatment could rarely be carried to an apparent cure. The tuberculin therapy is, however, recommended when it becomes legally possible to intern the natives until microscopical and other examinations show elimination of bacilla from dejecta.

L. C. Scott.

REPORT ON TUBERCULOSIS IN KILIMANDJARO.—(Staff Surgeon Dr. Wünn, *Ibid.*) Cases of tuberculosis have been on the increase from two in 1910-11 to 14 in the latter half of 1914. East Indians and Europeans are considered responsible for the infection and spread by the Wadschagga tribe. The cold and frequent fogs predispose the natives to diseases of the respiratory organs. L. C. S.

CLASSIFICATION OF THE AFRICAN TRYPANOSOMES PATHOGENIC TO MAN AND ANIMALS.—(Sir David Bruce, Transactions of the Society of Tropical Medicine and Hygiene, Vol. VIII, No. 1, November, 1914.) The monograph deals with the classification from the standpoint of morphology and animal susceptibility. It divides the trypanosomes into three groups: Group A, including *T. brucei*, *T. gambiense*, *T. evansi*, *T. equiperdum*; Group B, *T. pecorum*, *T. simiae*; Group C, *T. vivax*, *T. capræ*, *T. uniforme*. The article is followed by a discussion. L. C. S.

OPERATIVE TREATMENT OF FILARIASIS IN SAMOA.—(*Archiv für Schiffs-und Tropen-Hygiene*, Bd. 18, No. 23, 1914.) Thieme, of Apia, gives the symptomatology of the acute and chronic forms of filariasis, together with the treatment of deep-seated abscesses and phlegm. The greater part of the article is taken up with description of the technic in cases of elephantiasis of the scrotum, arm and leg, which consists essentially in resection of the hyperplastic tissue and replacement with healthy skin. The prognosis has been good, not a single case of the three hundred operated dying. Recurrence is quite frequent, however, as long as the patient remains in the filaria locality. L. C. S.

MYIASIS OF THE URINARY PASSAGES.—(Ernest F. King, *Journal of American Medical Association*, Vol. LXII, No. 26, p. 2285.) Mention is made of cases in the literature of urogenital myiasis followed by the author's case. The latter, a male, noted the passage of objects afterwards identified as the larvæ of the *Fannia scalaris*, or "latrine fly." It is supposed that the discharge from a posterior urethritis of gonorrheal origin served as the attraction for depositing its ova. These, according to René Chevreil, find the region around the meatus urinarius a suitable place for development from which the active larvæ wander up-

ward toward the urinary passages. Since the patient voided a larva 10 days before, it would seem that two separate infections had taken place.

L. C. S.

AN UNUSUAL CASE OF SCREW-WORMS IN THE NOSE AND NASAL ACCESSORY SINUSES.—(George U. Huber and Frank L. Flack, *Ibid.*, p. 2288.) The case described was that of a farmer with chronic syphilitic infection of the nasal passages which doubtless caused a fly to deposit its ova in the nasal cavity. Chloroform inhalation and operations on the sinuses, air cells and one lachrymal sac resulted altogether in the removal of more than 100 "ordinary Texas screw-worms." The treatment was surgical, aside from the chloroform inhalation. After-treatment consisted in blowing iodine into the nose and sinuses for one week and anti-syphilitic measures.

L. C. S.

ODIOMYCOSIS IN PORTO RICO.—(*Ibid.*, p. 2289.) According to E. R. Hildreth and A. C. Sutton, 150 cases of a like nature have been recorded, their case being the first in Porto Rico. The case, a native of Porto Rico, complained of lumps on the legs and pains in the chest, the first nodule appearing about the middle of May, 1914, on the outer part of the left leg below the knee, followed by others in the course of six weeks. The nodules were painful, and enlarged until they softened in the center. Patient had previously been affected by intermittent pains in the chest during the past two or three years, with cough and slight amount of mucus. Examination revealed nodules about an inch or more in diameter with fluctuation and deep purple skin covering it. Inguinal glands swollen on both sides. Dullness on left side near base of lung. Diagnosis was made from smears and stains of the pus obtained on incision of the nodules and examined in 10 per cent sodium hydroxide. It was found to contain ovæ and spherical bodies, some frequently budding. Aside from incision and drainage, the treatment consisted of wet mercuric bichloride dressings, ichthyol ointment, and potassium iodide solution of a 50 per cent solution, ten drops three times daily, increasing to twenty drops. Within a month and a half after first seen, patient apparently recovered.

L. C. S.

ON THE SPIROCHÆTAL INFECTION OF ULCERS IN CHINA.—(*A Preliminary Report.*) (H. E. Eggers, *The China Medical Journal*, Vol. XXVIII, No. 6, November, 1914.) A large amount of material in the form of smears from ulcers was collected from all over China, limited, however, to ulcers of the extremity. These were fixed in methyl alcohol and stained with Giemsa's stain. Six types (A-F) are described, classified according to length, convolutions and staining characteristics. Certain bacilli were found to constantly accompany some of the types; two varieties of fusiform bacilli and one short, plump, violet-staining organism. Altogether, 1500 specimens were examined, 115 of which contained spirochætes. Type (A) occurred most frequently and was associated with the typical tropical ulcer. Other types were found along with (A) and are naturally associated with it in the lesion, whether or not being an etiological factor in the cause of the lesion is not clear. The author concludes that at least one of the spirochætes is of clinical significance, the others are doubtful, no constant relationship can be shown between the types of bacilli and the spirochætes. From the limited material obtained, the central part of China seems to be the least involved; however, considering the magnitude of the country, this is necessarily inaccurate. An attempt will be made to collect 3,000 specimens and a future report will give more accurate details of the geographical distribution and observation.

L. C. S.

PLAGUE AND PLAGUELIKE DISEASE. A REPORT ON THEIR TRANSMISSION BY STOMOXYS AND MUSCA DOMESTICA.—(By N. E. Wayson, *Public Health Reports*, Vol. 29, No. 51, pp. 3390-3393.) The experiments described in this paper were conducted with *Stomoxys calcitrans* and *Bacillus pestis* and *B. tularensis*, a plague-like disease, and with *Musca domestica* and the latter organism. This is one of the few instances recorded of successful transmission of any bacterial infection through the medium of a blood-sucking fly, and the first record of such transmission of animal plague.

In the experiments with the stable flies the insects, previously starved, were induced to feed through gauze when applied to guinea pigs in the interrupted method of biting. Two success-

ful transfers were recorded with plague and four successes with the plaguelike disease. There was no appreciable interval between the biting of the diseased and healthy rodents. Two attempts to infect in intervals of one day and five days resulted negatively.

The transmission by bites occurs apparently only from those animals having an advanced stage of the bacteremia as indicated by their death within 48 hours after the fly feeding. It required eight to twelve bites in alternate applications to convey infection of the two diseases. Death resulted in five to nine days after flies were applied to the healthy guinea pigs. Washings of stable flies in normal salt solution and of flies slightly crushed when injected subcutaneously evidently produced similar positive results.

House flies used as mechanical porters in several trials proved capable of transferring infection from diseased viscera to healthy guinea pigs. The bacteria were carried by the flies in their digestive tracts, mouth parts and dejecta, when immediately transferred to abrasions upon healthy rodents. Evidently the pulselli of contaminated house flies proved negligible as vehicles of infection. In four of the successful experiments flies were allowed to crawl on infected viscera, then induced to crawl on healthy conjunctiva prepared by cocainization and traumatized by rubbing sterile sand between the ocular and palpebral conjunctiva. This resulted, after 48 hours, in a purulent conjunctivitis, and after five to nine days, the death of the animals with cervical adenitis and typical lesions in the viscera.

These findings are of epidemiological significance, inasmuch as Wherry (*Ibid.*, p. 3387) reports this rodent disease transmissible to man, and in the two human cases he cites ulcerative conjunctivitis and lesions analogous to those produced in the house fly experiments.

Since the fly experiments are still in progress, it is suggested that only laboratory-bred flies be employed, as the factor of previous infection cannot otherwise be eliminated, a feature of some importance where it is aimed to establish the rôle of insect porters of bacterial infection.

M. B. Mitzmain.

A SIMPLE TECHNIC FOR THE DISSECTION AND STAINING OF MOSQUITOES.—(By Harold Seidelin and Sophia Summers-Connal. Reprinted from *Yellow Fever Bureau Bulletin*, Vol. III, No. 3, September, 1914, pp. 193-197.) The traction method of dissection first advocated by Stephens is here employed. The improvement over the latter's method is claimed to be the drawing out of the digestive tract entire with the salivary glands attached. This is effected by traction on the head and thorax, freeing the salivary glands and air sacs, followed by the pulling out of the entire digestive tract through the thorax.

The sublimate-alcohol fixing method recommended appears to offer no advantage over that advocated by Patton and Cragg with Bless's formalin aceto-alcohol method. The latter leaves no uncertainty of the tissue adhering to the glass slide, facilitating manipulation and the delicate malpighian tubules do not become as easily entangled. A further advantage of the Bless method is its more rapid fixation and obviates the additional step of using iodine here required to remove the mercury retained in the tissues.

The stains recommended are iron-hæmatein, panchrom, Mayer's hæmalum, and Delafield's hæmatoxylin, the first two being preferred.

The technic applies particularly to the yellow fever carriers, but can with equal advantage be directed to the *Anopheles* and other species.

M. B. M.

NOTES UPON THE BIOLOGY OF *STEGOMYIA FASCIATA*.—(By Harold Seidelin and Sophia Summers-Connal, *Ibid.*, pp. 187-192.) The authors attempt to put a quietus upon the classical theory advanced by Marchoux and Simond of the French yellow fever commission of Rio fame. They claim that the dogma of nontransmissibility of yellow fever rests upon a tradition, experience elsewhere differing from that of Brazil, the present writers controverting the assertions of the French workers upon the results of their experiences in Africa.

From their experiments it appears that the females of the yellow fever mosquitoes bite indiscriminately at daytime and after dark, which holds good for old mosquitoes as well as recently emerged ones. The writers note that the explanation

suggested by Marchoux and Simond that yellow fever is transmitted at night only, rests upon a biological observation constructed upon the data obtained in two experiments in which not more than eight mosquitoes were used. In one a mosquito lived for eighteen days and in a similar trial a single female survived until the twenty-eighth day. Except that the single experiment is extended to a longer period (one of four females employed was induced to feed upon the sixty-seventh day) it seems that very little more of biological worth is advanced in this paper beyond the data contributed by the previous workers.

A short paragraph is added stating that mosquitoes can be reared in distilled water on sterilized food. *M. B. M.*

AN APPARATUS FOR FUMIGATION WITH CRESYL.—(By Harold Seidelin. *Ibid.*, pp. 209-213, 1 fig.) As a mosquito killing measure cresyl and cresol, the more purified product, have been used since 1912 with very satisfactory results. The objection noted with the usual method of application is the danger of fire during the evaporation of the substance in open containers. This the author eliminates by generating the fumes in a specially constructed closed retort directing the vapors by means of an extended spout into a room or hold of a ship.

All of the experiments recorded confirm substantially the findings of the French workers, Bouet and Rouband, in the following points:

The effective dosage was determined to be 5 grams per cubic meter at a cost of less than 2 cents per 1,000 cubic feet. Doors and windows of the fumigated room can be opened immediately after the evaporation of the cresyl is completed. And further, it is unnecessary to seal openings—so essential to sulphur fumigation. There is no deleterious action upon metal and foodstuffs. Man and domestic animals can support the vapors of cresyl without danger, although they are fatal for mosquitoes.

This is obviously a very important step forwards, as the method devised can be extended to the fumigation of large, more or less open, buildings and ships. *M. B. M.*

NOTES ON THE HYPHOMYCETES FOUND IN SPRUE; WITH REMARKS ON THE CLASSIFICATION OF FUNGI OF THE GENUS "*MONILIA* GMELIN 1791."—Castellani's paper (*Jour. Trop. Med.*, 1914, XVII, 305) is a very interesting presentation of the association of moulds with sprue. The author points out that Kohlbrugge found fungi in cases of sprue in 1901. Between 1909 and 1912 Castellani himself came to the conclusion that there were several different species of fungi associated with the disease, and in 1913, in connection with Low, he described a new species. It is easy in nearly every case of sprue to demonstrate the existence of fungi in the stools and in scrapings from the tongue. The author suggested as long ago as 1908, that classification of these fungi should be based on their action on litmus milk, gelatin, and carbohydrates and on their agglutination and immunization phenomena whenever possible, in addition to their morphological appearance. Some of these organisms coagulate milk, some do not; some render it acid without coagulating it; others discolorize the medium. The majority of the organisms do not liquefy gelatin, although a few do liquefy this medium. Glucose, saccharose, levulose, galactose, maltose, mannite, and lactose are usually sufficient for the identification of the different species of fungi from the point of view of their carbohydrate action. The following organisms have been isolated in various cases of sprue: *Monilia intestinalis*, Castellani, 1911; isolated in three cases of sprue. *Monilia faecalis*, Castellani, 1911; isolated in two cases of sprue. *Monilia insolita*, Castellani, 1911; isolated from the stools, saliva, and scrapings of the tongue from a case of sprue, from the stools of two cases of typhoid fever and a normal individual and also from sputum. *Monilia tropicalis*, Castellani, 1900; found in the stool of a case of sprue. This organism is frequently found in Ceylon in cases of bronchomycosis. *Monilia (?) rotundata*, Castellani, 1911; isolated from the stools of a case of sprue, a case of typhoid fever and a case of simple enteritis. *Monilia asteroides*, Castellani, 1914; isolated from the stools of a case of sprue and from the stools of a case of pseudosprue. These fungi Castellani believes are not identical with the so-called thrush-fungus. There are excellent photographs of cultures of three of these fungi.

J. M. Swan.

BERI-BERI IN PAPUA (British New Guinea).—Strong (*Jour. Trop. Med.*, 1914, XVII, 310) gives a short description of his experience with beri-beri in Papua. J. M. S.

THE SO-CALLED PLASMODIUM TENUE (Stephens).—Balfour and Wenyon (*Jour. Trop. Med.*, 1914, XVII, 353) criticise an article by Stephens, which described a new species of malaria parasite under the name of *Plasmodium tenue*. They reproduce one picture from the Third Report of the Wellcome Tropical Research Laboratory, at Khartoum, and a second colored plate illustrating the parasites found in an adult Arab, which resemble the parasite described by Stephens. The authors believe that there is no justification for making *Plasmodium tenue* a new species. They consider it a modification of *Plasmodium falciparum*. J. M. S.

ASIATIC CHOLERA.—McMillan's paper (*Jour. Trop. Med.*, 1914, XVII, 354) is chiefly interesting for the translation of a passage from Thucydides describing an epidemic of cholera. It points out that the word "carrier" was used as early as 1817 to denote a person apparently well, yet harboring virulent cholera bacilli in his intestines. The author points out that the word "infectious" as used in its true sense, was first applied to cholera. He makes the statement that he is convinced that a pill of colocynth and hyoscyamus is a remedy, if not a specific for the disease! J. M. S.

THE OCCURRENCE OF CERTAIN STRUCTURES IN THE ERYTHROCYTES OF GUINEA PIGS AND THEIR RELATIONSHIP TO THE SO-CALLED PARASITE OF YELLOW FEVER.—Wenyon and Low (*Jour. Trop. Med.*, 1914, XVII, 369) have investigated the structures seen in the red blood corpuscles of yellow fever cases, and called by Seidelin and Macfie and Johnston *Paraplasma flavigenum*. They have found similar bodies in the blood of normal guinea pigs born and bred in England. They are of the opinion that these bodies probably have to do with the development and degeneration of the red cells. They believe these bodies are not parasitic and that the evidence in favor of their being the parasites of yellow fever is destroyed. They believe that the presence

of such bodies in cases of yellow fever has no diagnostic significance apart from the evidence of blood alteration. The article is accompanied by an excellent colored plate. J. M. S.

THE TRANSMISSION OF *TRYPANOSOMA BRUCEI* OF NIGERIA BY *GLOSSINA TACHINOIDES*, WITH SOME NOTES ON *TRYPANOSOMA NIGERIENSE*.—Gallagher (*Jour. Trop. Med.*, 1914, XVII, 372) was in charge of the Sleeping Sickness Camp at Eket, Nigeria. He found that a polymorphous trypanosome, which was indistinguishable from the Zululand strain of *Trypanosoma brucei*, and very probably, (if not actually, identical with it, occurs in that country. This trypanosome is carried by *Glossina tachinoides*. He believes that this trypanosome and *Trypanosoma pecaui* are identical, although not always transmitted by the same species of glossina. He thinks there is ground for the belief that *Trypanosoma nigeriense* is not identical with *Trypanosoma gambiense*. He says that it is desirable to demonstrate a posterior-nuclear producing trypanosome among the more fatal cases of human sleeping sickness by inoculating every human case into animals. J. M. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

Transactions of the Society of Tropical Medicine and Hygiene, December, 1914, Vol. VIII, No. 2.

BOOK REVIEW

FLIES IN RELATION TO DISEASE. BLOOD-SUCKING FLIES. Edward Hindle, University Press, Cambridge, England.

This is issued as a companion work on Non-Blood-Sucking Flies, published in 1913, in the Cambridge Public Health Series.

The author devotes special attention to the modes of life of the more important insects discussed, the manner of disease transmission, and measures recommended for prevention.

In order to appreciate the rapid progress made in medical entomology, the author points out that the present volume is entirely concerned with discoveries of the last twenty years. The few observations acquired on mosquitoes and filaria are the only exceptions.

The present work, except in isolated cases, does not refer to articles published later than the beginning of 1913.

The general arrangement of the subject matter, which has been adopted, provides for an introduction with a brief discussion of the modes of insect transmission of disease. Follow then chapters on the structure and classification of the Diptera accompanied by a list of biting flies known to transmit any infection. Each family including any such carriers of disease is then dealt with separately, and in most cases some important member of the family is described in greater detail. The description of the infections immediately follows that of the family. In cases of diseases transmitted by members of more than one family, such infections have been described in connection with their more important carrier. At the end of each chapter are given a few references to the literature on the subject, not a complete bibliography, however, but merely titles of publications that will be of assistance to students requiring detailed information in any particular branch.

Two exhaustive lists are included, showing in one the species of Diptera known or supposed to convey any infective agents and in a more elaborate list there is tabulated a series of 241 species of *Anopheles* with synonymy and relationship to malaria. In the latter table notes are included giving complete references to the claims made of specific relation-

ship. The evidences of transmission are cited whether observed epidemiologically, naturally or experimentally, giving the stages of development observed with the investigator of the various species.

In the systematic arrangement of the *Anophelinae* Hindle makes use of the general scheme of the natural affinities of the group given by Christophers. Edwards is then followed for the generic characters of *Culicinae* and the tables for the differentiation of the species of *Stegomyia* is essentially that of Theobald. The synoptic tables of the remaining groups of flies have been taken with modifications, mostly from Alcock and Austen.

As a criterion of the trend of research in medical entomology, it is noted that the space devoted to mosquitoes and malaria is equalled by that given to the consideration of tse-tse flies and trypanosomiases. In the chapters on *Glossina* and disease the author has summarized the available information concerning the bionomics of all species of *Glossina* that have been proved to carry infection together with a review of details of experiments and observations on the latter point.

The section on the life cycle of the malarial parasite in man and in the mosquito gives the information required by the student in an unusually lucid and convincing manner.

The chapter devoted to mosquitoes and filariasis is very complete. It is enhanced in value by a table listing 20 species of mosquitoes capable of acting as intermediate hosts for *F. bancrofti*.

The facts concerning the rôle of mosquitoes and flies in the dissemination of the fevers of unknown etiology are elucidated with masterly discrimination. Discussion of relationship of carriers to bacterial diseases and other infections which have only dubious epidemiological or experimental basis has been adroitly avoided.

The work in general is a painstaking and praiseworthy contribution.
M. Bruin Mitzmain.

REPRINTS.

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MARSHALL, ALEXANDER. A Simple Method of Staining the Amœbæ Parasitic in Man. Reprinted from the *Laboratory Manual*, September, 1914.

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VOL. II.

MARCH, 1915

No. 9.

EDITORIAL

Germ of Yellow Fever Still Undiscovered.—More than one organism has been advanced as the causative agent in yellow fever, but in no case have the hopes of the claimant been realized. Sannarelli's organism enjoyed its brief period of fame. Sternberg's find was shown to be not the *causa morbi*. And now the latest in the field, Seidelin's *Paraplasma flavigenum*, has traveled the same road as the others.

The investigations of Seidelin in Yucatan have already been noticed in these pages. In Cuba, Agramonte, Cartayo, Guiteras, and others, showed that the bodies described by Seidelin as the specific organism of yellow fever were found in the blood of persons not suffering from yellow fever. Seidelin claimed that the organisms referred to were not identical with the one described by him. The matter remained in this state until Seidelin claimed to have produced yellow fever in guinea pigs by inocu-

lating yellow-fever blood, and had found in the inoculated animals bodies like those described by him.

Such a claim is not only interesting from a pathological standpoint, but, if substantiated, would be of very grave import in epidemiology, since it would mean that some of the lower animals could act as reservoirs and carriers for the yellow fever poison, and thus be always ready to furnish material for a fresh outbreak. It is at this very point that Drs. C. M. Wenyon and George C. Low intervene to show that the basis on which Seidelin built his theory is entirely erroneous, and that there is no reason to fear what would be a very great danger indeed, were Seidelin's contention well founded. Seidelin found in the blood of inoculated guinea pigs certain minute bodies in the red blood cells; Wenyon and Low examined the blood from new-born guinea pigs, and found the identical kind of bodies that Seidelin called the *Paraplasma flavigenum*, and claimed for them the essential rôle in the causation of yellow fever. Wenyon and Low's guinea pigs were examined in England, where yellow fever does not exist. The bodies seen by these investigators are found so constantly in new-born guinea pigs that the parasitic theory of Seidelin becomes untenable. It is to be noted here, that Seidelin had never examined the blood of new-born guinea pigs, else he would not have been led into giving the intracorpusecular bodies he found undue importance.

Seidelin's position is this: He describes certain structures in the red blood corpuscles in yellow fever as the specific organism and refuses to admit that bodies found by other investigators in other diseases are not identical with his own. In Mexico, he found his bodies in the blood of apparently healthy school children. He does not see in this a refutation of his theory, but insists on believing that these children are really yellow fever carriers. There are other awkward situations into which his theory has led him, but no amount of enthusiasm for

an idea can overcome the obstinate facts brought out by Wenyon and Low.

These latter investigators are convinced that these bodies have no diagnostic value whatever in yellow fever. Therefore, they warn inexperienced observers not to accept the presence of such bodies as evidence of yellow fever. The bodies are so minute and obscure that a specially trained expert is frequently in doubt as to whether they are purely artefacts or not. Still, it must be remembered that the bodies found in guinea pigs' blood are not artefacts, and are definite entities, though not parasitic. Wenyon and Low believe that in yellow fever cases many of these bodies can be related to the development of the erythrocyte from a nucleated red cell, though in some instances they represent basophilic or other degenerative changes.

Thus ends another chapter in the history of yellow fever. The germ is there, though not yet brought to light. It seems to be as difficult to find the germ of yellow fever as that of hog cholera, which is ultra-microscopic, but not less real or dangerous on that account. The history of the *Spirochæta pallida* shows us how long it may be before we reach our goal; but we cannot doubt that science, with its constantly increasing armamentarium, will eventually track the elusive germ to its hiding place, and thus add another to its triumphs over the destroyers of mankind.

A. McShane.

ORIGINAL ARTICLES

OBSERVATIONS IN TROPICAL PATHOLOGY. II.

THREE FREQUENTLY SILENT LESIONS:

GASTRODUODENAL ULCERS, GALL-STONES

AND PANCREATITIS.

THEIR RELATIVE INCIDENCE IN PANAMA CANAL LABORERS AS DISCLOSED BY AUTOPSY.*

By

H. C. CLARK.

From the Board of Health Laboratories,
Ancon, Canal Zone.

Since the advent of surgical treatment and the development of certain laboratory methods of diagnosis relating to these diseases, the clinicians have been able to assemble much valuable data bearing on their etiology, diagnosis and treatment. The general experience gained by exploratory laparotomy and autopsy still shows, however, that some cases do not declare their presence and that some clinical pictures thought to faithfully represent one of these conditions proves to be another or some combination of the group that has succeeded in evading detection even in the hands of skilful clinicians¹.

Many times some accident or sequel to one or more of these factors may be the first indication of illness to the victim and when the appeal is made to the clinician for advice and treatment, the primary factor is thoroughly concealed by peritonitis, hemorrhage, abscess, carcinoma, diabetes or some other remote result. Such cases only indicate that "inevitable mistakes in diagnosis"² must occur where so many important structures are found in close proximity, and are so closely related in their anatomical position and their blood, nerve and lymphatic supply.

*Permission for publication has been granted by Colonel Charles F. Mason, Medical Corps, U. S. Army, Chief Health Officer, Panama Canal.

Three of the commonest lesions found in the abdomen occur in the viscera of the epigastrium and that immediate neighborhood: the gastro-duodenal segment of the alimentary tract, the gall-bladder and ducts, and the pancreas. Probably more partial or complete mistakes and delays in diagnosis occur here than in any other small area of the body. It is quite possible at times for a lesion in one or more of these structures to lead a latent existence or to masquerade under the clinical picture and features said to belong to the other. It also frequently happens that all features, which constitute the accepted symptom complex of any one of these conditions do not occur in a single case. Under such circumstances the diagnostician is often forced to rely on the chief complaint and his own observation coupled with the choice of a disease which has shown these features in the greatest frequency in his own experience. Thus it is easy to see how the personal statistics of one observer might indicate the prevalence of one of these diseases, while another would indicate some other member of the trio. It is possible for skilful observers working with different classes of clinical material to differ in their valuation of signs and symptoms and it is not surprising to find on consulting one authority that chronic indigestion, and local tenderness in or near the epigastrium in obscure cases usually means gall-stones, while another will feel that it indicates peptic ulcer, and another pancreatitis, another chronic appendicitis.

All diagnosticians arrive at an opinion through much the same channels, that is, they are forced to accept and weigh the evidence obtained by inquiry and try to correlate personal observations and laboratory results with this history. If the patient can give, in a truthful chronological order, the complete history of the full course of the disease, few indeed are the mistakes recorded in cases where a lesion has declared itself. Such classical conditions frequently do not exist and therefore indirect and differential methods are used with varying success.

The autopsy not infrequently shows that an organ may be the seat of an extensive lesion, and yet the function of that organ may not have been interfered with to the extent that will permit a clinical observer to identify disease. On the other

hand, autopsy will sometimes reveal a small lesion advantageously located that has offered abundant clinical evidence of disease and its location. Again there are times when large cicatricial areas are accidentally found so located that it would seem impossible for the individual never to have been aware of its presence or to have been favored with a spontaneous cure. It must, therefore, be true that a certain percentage of individuals suffering from some types of disease are never aware of its presence and that at times spontaneous cure results or a latent course is run.

Statistics built solely on clinical records in such diseases do not represent the actual incidence of the disease and some of the features or accidents in relation to it. The present analysis of 2,100 autopsies has been conducted in order to determine the following:

- (1) The relative incidence of gastric and duodenal ulcers, gall-stones and pancreatitis found at autopsy at Ancon.
- (2) Any probable inter-relation of the three conditions.
- (3) How many apparently failed to offer clinical evidence of their presence.
- (4) What probable etiological factors may have been present.
- (5) Number and character of accidents and sequelae found.
- (6) Number of spontaneous cures apparent.

The autopsies and observations here recorded represent the work of one man, thus making it possible to continue a uniform method of searching the three systems.

The individuals included in the series are nearly all young male West Indian negroes who had spent their lives on the islands and on the Isthmus of Panama and were thought to be in good physical condition at the time they were recruited for service on the Panama Canal Zone. Their diet, perhaps, did not include as much meat as that of people who live in the temperate zones. Vegetables, fruit and fish constituted most of it. Practically all of them were outdoor laborers. It is believed by the clinicians that they are much less susceptible to pain than the other races, and it is certainly true that they are

seldom able to offer all the details in regard to the onset of an illness.

To condense the subject as much as possible the results of the analysis will be made in a tabular manner and the following table is arranged to present the race, sex and age incidence:

	Gastro- duodenal ulcers.	Gall- stones.	Pan- creatitis.	Total individuals autopsied.
West Indian negroes.....	82	49	8	1,598
Latin Americans (mestizo).....	7	15	1	274
White race.....	5	8	2	222
Yellow race.....	1	0	0	6
Totals.....	95	72	11	2,100
Males.....	82	52	9	1,743
Females.....	13	20	2	357
Totals.....	95	72	11	2,100
Under 30 years of age.....	37	21	6	1,132
30 years to 40 years.....	26	20	2	481
41 years to 50 years.....	19	12	2	296
51 years to 60 years.....	10	11	1	123
61 years to 70 years.....	3	5	0	46
Over 70 years.....	0	3	0	22
Totals.....	95	72	11	2,100

Gastro-Duodenal Ulcers.

The cases grouped under this heading include all that have shown the typical peptic ulcer and any acute or chronic ulcers associated with a general disease, chemical poison or malignancy, as well as large scars of a definite character.

Reference to the general table will show that 95 cases presented some of these lesions. They were present in males 82 times and females 13 times, a ratio of a little over 6 to 1. When the sex percentage is obtained, however, it would appear that little difference exists.

The frequency of the lesion would appear to be higher between the years 30 and 50, yet they were found at all ages, and when the percentages are worked out for each period mentioned in the table, it would indicate a slight increase in frequency as age advances.

Location of the lesions found:

Confined to the duodenum in.....	39 cases
Confined to the stomach in.....	38 cases
Present in stomach, pyloric ring and duodenum in.....	13 cases
Present in stomach and pyloric ring in.....	2 cases
Present in the pyloric ring, only, in.....	2 cases
Present in the stomach, duodenum and oesophagus in.....	1 case

It will be noted that in the series the lesions were found as often in the duodenum as in the stomach, and the typical round chronic peptic ulcer was more often found in the duodenum than in the stomach. This is not in harmony with some statistics. Of those lesions found only in the duodenum, nine cases had a multiple lesion and 29 cases had a single large ulcer or scar. Of those cases in which they were confined to the stomach, there were 24 cases presenting a multiple lesion and 14 presenting a single one. What appeared to be typical "contact ulcers" were found 4 times in the stomach and 6 times in the duodenum. A little more than three-fourths of the gastric ulcers or scars were located in the extreme pyloric end and chiefly in the lesser curvature and posterior-superior wall of that portion. Nearly all scars and ulcers of the duodenum were in the first portion of that structure (a few exceptions will be mentioned under gallstones, in regard to scars and ulcers of the Ampulla of Vater).

For the location of the larger ulcers and scars see the following table:

	No. of cases.	Chronic ulcers.	Large scars.	Perforations	Severe hemorrhage.
First portion of the duodenum.	14	—	—	0	0
Scattered small lesions.....	18	7	11	1	1
Floor, only.....	6	6	0	2	0
Floor, anterior and posterior walls.....	1	1	0	1	0
Floor and anterior wall.....	3	3	0	2	0
Floor and posterior wall.....	6	5	1	2	0
Antero-superior wall.....	5	5	0	3	0
Postero-superior wall.....					

The table shows that a large acute hemorrhage had occurred but once in the duodenal ulcers, while perforation had happened eleven times.

It is very interesting to note that the commonest location of the large single lesion in the duodenum was in the *floor* of the first portion where it lies over the head of the pancreas. Eleven out of eighteen of the lesions found here were huge puckered scars or apparently inactive lesions. Only two accidents had occurred here. It would seem that the head of the pancreas tended to mobilize this area in the duodenum and offers a better opportunity for spontaneous cure.

Most all the lesions which had perforated were in the more distensible portions of the gut and spontaneous healing was scarcely ever noted. In those ulcers located over the pancreas

and which extended up either or both walls of the gut, perforation had occurred at the edge of the pancreatic attachment. It would seem that invasion of the head of the pancreas would necessarily follow the presence of ulcers in this region but only a few at the time of autopsy revealed such a state.

See the following table in regard to some of the ulcer accidents or sequelæ in stomach and duodenum :

	Hæmorrhage, Severe.	Perforations.	General Peritonitis.	Local Peritonitis.	Stenosis.	Malignancy.	Liver Abscess.	Subphrenic Abscess.
Gastric Ulcer.....	4	3	1	7	6	5	0	0
Duodenal Ulcer.....	1	11	10	5	0	2	2	2
Totals.....	5	14	11	12	6	7	2	2

This series would indicate that perforation is the commonest serious accident to the duodenal ulcers and that malignancy and acute severe hæmorrhage are rather unusual.

On the other hand hæmorrhage of an acute severe form, and malignancy are more common in the gastric lesions than is perforation. It is of course impossible to say in the gastric series whether the ulcer was a sequel to the tumor⁴ or vice-versa, but the ulcers were so large and so typically located that they have been included.

The two cases of malignancy associated with duodenal ulcers appear to be developments in the margin of the ulcers. The large chronic peptic ulcer of the usual type described occurred in only 72 of the 95 cases mentioned. The other cases either presented a single large ulcer or numerous small ulcers which seemed to deserve mention in the series if for no other purpose than to suggest probable etiological factors for some of the forms which have been included as the typical peptic ulcer⁵.

The following list is arranged to show these lesions and the disease found in association :

Pneumococcus Infection (Lobar pneumonia and septicæmia).....	3
Tuberculosis	2
Typhoid fever	2

Enterocolitis (in children).....	2
Pyemia	1
Tetanus (treated with large amount of anti-tetanic serum)	1
Epidemic meningitis (treated with large amount of serum).....	1
Corrosive poison.....	1
Epithelioma of the nose and mouth (tube feeding).....	1
Acute miliary abscesses of entire wall of duodenum localized peritonitis.....	1
Strongyloidiasis (involving mucosa of stomach and duodenum).....	1

The remainder were represented by black, moth eaten, lace-like patterns of ulceration or erosion in the mucosa of the duodenum or were irregular scars and ulcers associated with cardio-renal diseases. Intestinal parasites could not be incriminated as possible etiological factors in any but the one case mentioned above, but it would appear that various forms of local or general inflammation of some portion of the intestinal tract and the prevalence of uncinariasis would tend to vitiate the occult blood test so frequently used in the diagnosis of ulcers of the stomach and duodenum.

The striking association of acute and chronic general infections and of chronic arterial diseases found in association with the gastro-duodenal ulcers and scars of this series strongly suggests vascular disturbance as a primary cause of the ulcers.

Note the following diseases found in association with the peptic ulcer of this series:

Arterio-sclerosis	25
Syphilis	22
Organic disease of the heart.....	7

Aside from these tuberculosis was found associated 15 times, typhoid 3 times, pyemia 7 times, and so might be mentioned more infrequent infections as well as chronic nephritis and abdominal lesions which by a succession of events⁶ might have offered factors of etiological importance.

In this series of autopsies aneurism had occurred 45 times, cerebral hemorrhage 28 times, and cerebral softening 24 times. Peptic ulcers were found in association with some one of these conditions 5 times. It would seem reasonable to suppose that

peptic ulcers especially of the duodenal⁸ type might have a similar etiology. It has been shown that peptic ulcers caused by syphilis or tuberculosis need not present the histo-pathology of these diseases for the primary disease may be in the vessel and the ulcer will simply bear the same relation to the vascular lesion that an infarct does to its etiological factor.

There were ten cases of peptic ulcer in this series which failed to reveal gross evidence of arterial disease. The Wassermann test was not applied before or after death. No past or recent history was available which could throw any light on the probable origin of the lesions.

Nine cases of fatal burns occurred in the series of 2,100 autopsies but no gastro-duodenal ulcers were present. The ulcers and scars occurring in this anatomical series and the conditions found in association with them would lead one to believe that chronic vascular disease plus the peculiarity of the blood supply, especially to the duodenum⁸ and the mechanical demands which the functions of these organs bring to bear on the pyloric end of the stomach⁷ and the first portion of the duodenum are the chief factors in the production and localization of most chronic types of ulcers in this region. This is in accord with the old view of Virchow⁹ which has been more recently emphasized by Ophüls¹⁰.

It is unreasonable to suppose that such lesions may find their etiology, at times, in diseases common to the lymphatic structures such as typhoid and tuberculosis. The direct extensive of gall-bladder disease through the common network of lymphatic channels might form the groundwork for some ulcers to become established. Certain cases to be mentioned later in this series tend to confirm this.

The analysis of the clinical records, in these ulcer cases and those presenting large scars or a carcinomatous factor, shows that only 19 had offered any clinical evidence of trouble of this character. Most of these had only sought admission after perforation or severe hemorrhage had occurred or after an extensive invasion of the tissues. In twelve of the individuals, large puckered scars were found in the duodenum which indi-

cated spontaneous cures of large ulcers and small scars were not infrequently found in both stomach and duodenum.

In Autopsy 3,491, a case presenting evidence of tertiary syphilis and organic disease of the heart, there were large discrete and communicating scars in the pylorus, the pyloric ring and the first division of the duodenum. There was no history of a corrosive agent. In practically every case where surgical interference had been demanded the ulcer was located in the duodenum.

The collected anatomical data in the series also shows that such accidents as perforation and acute severe hemorrhage do not occur with the high rate of frequency that most statistics indicate but that the percentage of such accidents is very high in those instances where the ulcers have made themselves known in a clinical manner.

It is also shown that spontaneous cures do occur in even large lesions if they are advantageously located and that this happens more often than is generally believed.

Many ulcers lead a silent or at least uneventful existence.

Gall-Stones.

Cholelithiasis stands second to gastro-duodenal ulcers in the order of frequency. The general table will quickly show the principal points in regard to race, sex, and age. In seeking for probable etiological factors it was possible, in all but twelve cases, to find either a history or the anatomical evidences of an old or recent inflammatory disease of the intestinal tract, peritoneum, or some abdominal organ. The inspissating influence on the bile of malaria fever and blackwater fever, is also open to question as an important etiological factor. In nearly all the cases revealing cholelithiasis, the stones were found lying free in the gall-bladder. Twelve cases were noteworthy from a clinical viewpoint.

Case I. History No. 139700. A male negro baby of four months died of an acute entero-colitis and had a coincident cholelithiasis. Two stones in the gall-bladder; one was loosely engaged in the entrance of the cystic duct.

Case II. A-3731. A black boy of four years. Death due to a wide-spread pneumococcic infection with an associated attack of estivo-autumnal

malaria. The gall-bladder was under great tension and felt like a bag of putty. When opened, a puttylike mold of inspissated bile, the shape of the gall-bladder cavity, was lifted out and handled without destroying the shape of the specimen. The common bile duct was patent.

Case III. A-3514. Stone found encapsulated in the cystic duct and there was a pouchlike formation of the lower end of the common duct, with an absence of the Ampulla of Vater. It strongly resembled a diverticulum of the duodenum. However, both the common bile duct and the pancreatic duct emptied into this pouch and it bore the evidence of scar formation.

Case IV. A-3632. This was another case of lodgment in the cystic duct plus a purulent cholecystitis, and a chronic gastric ulcer was also found in association.

Case V. A-3830. A case of cystic duct conclusion in a male Barbadian negro of 36 years. He had been operated on within the year for gall-stones and the bladder and ducts emptied of stones. His death was caused by a widely disseminated tuberculosis but there were present seven large stones in the gall-bladder and the cystic duct. The cystic duct was obliterated. No doubt this represents a recurrence of cholelithiasis.

Case VI. A-3885. Cystic duct conclusion by a calculus.

Case VII. A-3934. Fifteen small, black, shotlike stones, free in the gall-bladder. No mechanical disturbances. This case may have been one of acute infectious jaundice for there was marked jaundice, and it presented the appearance at autopsy of a septicemia, yet the cultures were sterile and no factor could be found to explain the presence of jaundice. It suggested, to the clinicians, gall-bladder disease.

Case VIII. A-3892. This was a case in which sand and a thick orange-colored paste were found in the gall-bladder and cystic duct. All ducts were patent, but near the end of the common bile duct a mass of adhesions were found and a pouch ran off to the duodenum, entering more or less parallel to the duct and just above the Ampulla of Vater. It is believed that it represents the tract of ulceration of a gall-stone through the duct and into the duodenum without passing through the Ampulla.

Case IX. A-3633. This also appears to represent a spontaneous effort, because the common bile duct was a huge channel, almost admitting a finger, and opened into the duodenum at the usual place, but without the characteristic appearance of the Ampulla of Vater. Its position was surrounded by a cicatricial lesion and directly opposite in the wall of the duodenum was a thinning out and pouching of the wall, that suggested an old "contact ulcer" which on healing had left a weakened wall and permitted pouching.

Case X. A-2162. A male Barbadian negro of 21 years, who died of diabetes mellitus and who revealed at autopsy both biliary and pan-

creatic calculi. The pancreas was almost totally destroyed. Its remnant being a stiff, hard mass, about three and one-half inches by three-fourths of an inch. There were two long bulletlike calculi in its dilated, thickened duct. The probable primary cause of the diabetes and pancreatitis was found when three large gall-stones were removed from the lower end of the common bile duct. They were so located that bile could flow down the common duct and up to the pancreatic duct. The gall-bladder and all the biliary passages were dilated and under great tension. Under pressure, a very little bile would escape around the stones into the intestine.

Case XI. A-2994. A female Jamaican negro who died of carcinoma of the gall-bladder and the bile duct. In the center of the malignant gall-bladder was found a nut-sized, pear-shaped calculus filling the small cavity, yet remaining in the fundus of the gall-bladder. Whether the stone was a sequel to the carcinoma,¹¹ or vice-versa, is an open question. Good authorities champion each side.

Case XII. A-3504. This was a Greek male of 38 years. A clinical diagnosis of abscess of the liver was made and at operation one was found in the left lobe and was drained. The course of the disease continued, resulting in death. Dissection of the biliary system was started at the Ampulla, where the ball valve action of a huge calculus was demonstrated. It was so near out of the end of the duct that the mucosa of the duodenum over the course of the duct was thrown up into a molelike burrow. On continuing the dissection up the common duct, the cystic duct was found more or less obliterated and some small calculi were lodged in it. The gall-bladder was thickened and contracted and contained a few small stones. A buttonlike thickening in the wall suggested malignancy, and on microscopic examination a deep-seated adenomatosis with distortion was found that strongly supported the idea. No glands in that region of the abdomen, however, revealed metastasis. Continuing up the hepatic ducts, gall-stones were found in abundance throughout the liver and clusters of abscesses had formed in the left lobe. A similar case in a negro is on record at Ancon, occurring before the time of this series. Here again it is demonstrated that lesions may exist which are relatively inaccessible to diagnosis and which may lead an uneventful existence.

Pancreatitis.

Under this heading it is not the intention to include those cases which are associated with some widespread dissemination of a disease, such as pyemia or tuberculosis. However, it is worth while to note that this organ was seldom found the seat of metastatic lesions, either inflammatory or malignant, in this series. Apparent primary disease or inter-related disease with neighboring organs, malignant tumors excepted, will be grouped for analysis. See again the table for factors in regard to race,

sex, age, and frequency. Brief reference will be made to the cases found.

Autopsies 2,832 and 3,239 were both performed on negro babies of fifteen months, and each presented a case of acute diffuse suppurative pancreatitis. It was the only important lesion in the first case; the second case having an associated entero-colitis. A severe form of a secondary anemia was present in each case. No glycosuria.

Autopsy 2,162 was described under gall-stones. Glycosuria present.

Autopsy 3,025: a male negro, 44 years old. Profoundly anemic individual, with an extreme degree of emaciation. The principal lesion found was in the epigastrium. A dense mass of adhesion concealed the pancreas and when dissection was completed a small hard fibrous mass was found, which here and there showed little tufts of pancreatic tissue set in a dense fibrous framework. The tortuous dilated ducts contained sand and small calculi. The fibrosis was so extensive that it was not thought possible for it to functionate, yet a test on the urine failed to demonstrate glycosuria. It cannot be said with too much certainty, that this instance did not follow former gall-stone disease, for although no stones were found, yet a great mass of adhesions were present about the gall-bladder, the gall-ducts and liver, and the ducts were thickened and somewhat dilated and tortuous. No duodenal or gastric scars or ulcers were present. The Wassermann test was positive, so syphilis is open to question as an etiological factor.

Autopsy 3,990. This represents a similar case, but not quite so advanced. It was associated with cirrhosis of the liver, chronic nephritis, and pulmonary tuberculosis. No suggestion of gall-stones or duodenal and stomach lesions.

Autopsies 2,836, 2,919, 3,747, and 3,633 represent localized disease following perforation of a duodenal ulcer into the head of the pancreas, or a direct extension of the inflammatory process.

Autopsies 3,489 and 3,164 are instances of acute peripancreatitis¹² recognized at autopsy as an extension of neighboring inflammatory disease. Aside from the diagnosis of diabetes in

Autopsy 2,162, none of these pancreatic lesions had been known to the clinicians, and they did not respond later to clinical tests that could be applied.

The cases showing a probable inter-relation of gastro-duodenal ulcers, gall-stones, and pancreatitis, can best be shown by a glance at the following table:

Autopsy No.	Gall Stones.	Duodenal Ulcer.	Gastric Ulcer.	Pancrea- titis.
2162.....	x	0	0	x
3499.....	x	0	x	0
3514.....	x	x	0	x
3632.....	x	0	x	0
3633.....	x	x	0	0
3892.....	x	x	0	0
2836.....	0	x	x	x
2949.....	0	x	0	x
3025.....	?	0	0	x
3164.....	0	x	0	x
3747.....	0	x	0	x
2287.....	x	x	x	0
2398.....	x	0	x	0
2411.....	x	x	0	0
2899.....	x	x	0	0
3012.....	x	x	0	0
2975.....	x	0	x	0
3408.....	x	x	0	0
3412.....	x	x	0	0
3717.....	x	0	x	0
3980.....	x	x	x	0

A summary reveals:

Gall-stones or acute cholecystitis and gastro-duodenal ulcers in association.....	14 times
Gall-stones and pancreatitis in association.....	2 times
Gall-stones, gastro-duodenal ulcers and pancreatitis in association.....	1 time
Gastro-duodenal ulcers and pancreatitis in association.....	4 times

Conclusion.

When race, sex, diet, occupation and age are studied in relation to this series, it would appear that age bears the most important relation to the incidence of these conditions, especially to gall-stones and ulcers and, therefore, indirectly to the

third member of the trio. As age advanced the individual ran the gauntlet of a greater number of diseases which may have acted as predisposing factors. It is worth recalling, however, that instances of each disease have occurred in all stages of life. For example, note the two cases of gall-stones occurring in children of four months and four years of age respectively; the two cases of acute pancreatitis in children of fifteen months; the instance of a fatal hemorrhage from a peptic ulcer of the duodenum in a child of nine months.

It is surprising to find so many of these conditions occurring in an apparently healthy young adult male negro population. The old idea of the preponderance of the gastric ulcer over the duodenal type is not borne out in this series, and it is not supported by recent surgical statistics.

The result of the analysis shows that gastro-duodenal ulcers rank first in order of frequency when both acute and chronic lesions are considered, and that chronic peptic ulcers occurred with the same frequency as gall-stones. Pancreatic disease, either local or general, was rarely encountered and then usually as a result of gall-stone or ulcer associations which acted as etiological factors.

There was a coincident occurrence of two or more members of the trio in twenty-one of the individuals; gall-stones and ulcers of the duodenum or the stomach occurring together in 14 cases; gall-stones and pancreatitis in 2 cases; gall-stones and ulcers and pancreatitis in 1 case; ulcers and pancreatitis in 4 cases.

It is plausible to believe that gall-stones and gastro-duodenal ulcers may at times be predisposing factors, one to the other, and it is certainly true that gall-stones and duodenal ulcers may at times produce pancreatitis.

Clinical evidence had been offered in 19 of the cases of gastro-duodenal lesions; in 12 of the gall-stone cases, and in only one of the cases showing pancreatic disturbance.

Probable etiological factors found associated with gastro-duodenal ulcers were; arterial diseases, acute and chronic general infections, and neighboring infections such as gall-bladder disease.

Probable etiological factors in gall-stone production were intestinal inflammations, an inflammatory condition in some abdominal organ, and the inspissating influence on bile of malarial infections.

Probable etiological factors in relation to pancreatitis were gall-stone lodgment in common duct and extension of inflammatory process from duodenal ulcers.

The commonest accident found in the ulcer series was perforation and this usually occurred in the duodenum. Acute severe hemorrhage was an infrequent accident and usually occurred in the stomach. Other sequelæ were localized peritonitis near the ulcers, abscess formation in the liver, pancreas or subphrenic positions.

Malignancy was occasionally noted and more frequently encountered in the stomach.

Stenosis was not found to a marked degree except in the gastric ulcers associated with malignancy.

The gall-stone accidents were principally those of lodgment in the ducts and the less frequent noted sequelæ were intra-hepatic cholelithiasis and abscess formation; pancreatic destruction due to the secondary influence of gall-stones in the end of the common duct; ulceration of stones from common duct into the duodenum; and two questionable carcinomatous developments in the gall-bladder due to gall-stone irritation.

Spontaneous cures were many times apparent in the duodenal ulcers and sometimes in the gastric ulcers. Similar cures had occurred apparently in gall-stone cases where ulceration from the biliary channels into the duodenum had occurred. It appears that a large number of gall-stones and gastro-duodenal ulcers lead a latent life and that the pancreas must lose a considerable portion of its tissue before it discloses, by a clinical test, impairment of its function.

It is reasonably safe to conclude that there is no other anatomical region of equal size in which there are so many closely related viscera that frequently harbor latent lesions capable of masquerading under so many deceptive clinical pictures, and the negro race must be kept in mind as victims

of these three conditions when a differential diagnosis of an obscure condition in the upper abdomen is being considered.

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CHAPARRO AMARGOSA IN THE TREATMENT OF AMŒBIC DYSENTERY.

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The group of symptoms commonly called dysentery has been known since the earliest times. In the very early medical writing references are made to this disease and emphasis is laid on the part it has played in the medical history of the nations. But it remained for Modern Medicine to differentiate a confused clinical picture into two distinct types, amœbic and bacillary dysentery. Lamb of Prague in 1859 was the first to study and describe amœbæ in the stools of a case of dysentery. His work was followed by the observations of Loesch, Cunningham, Koch, Kartulis, Osler and others, and it was clearly shown that amœbæ are the cause of one type of dysentery. Some observers, however, were inclined to doubt the etiological significance of the amœba and the situation was not clarified until the publication of the epoch-making observations of Schaudinn in 1903.

And here I want to digress just a moment. We are all familiar with Schaudinn's work on malaria and we all know that he was the first to demonstrate that the *Treponema pallidum* is the cause of lues, but it is not generally known that he sacrificed his life to science. We will remember Rickett's untimely death from typhus fever in Mexico; our memory is less distinct of the heroic death of young and lamented Lazear from yellow fever, of whom President Elliott has so beautifully said, "With more than the courage and devotion of the soldier he risked and lost his life to show how a fearful pestilence is communicated and how its ravages may be prevented." But our memory is clouded to the fact that Fritz Schaudinn also risked his life and lost it and that he is a particularly bright star in that immortal galaxy of medical martyrs. In this work-a-day world we live so fast that we haven't time to stop and think of the medical heroes and pioneers who have gone before, the

latchet of whose shoes we are not worthy to unloose. Schaudinn in 1902, working at Rovigno on the shores of the Adriatic, in his enthusiastic desire to prove the pathogenicity or non-pathogenicity of the different species of amœbæ, had the courage to swallow cysts of the organisms and suffered from two severe attacks of dysentery as a consequence. Four years later his eventful career was ended by deep suppuration around the sigmoid, a sequel doubtless of his tragic experiment.

Schaudinn showed that at least two species of amœbæ occurred in the dejecta of man, one pathogenic and one non-pathogenic; to these he gave the names "*Entamœba histolytica*" and "*Entamœba coli*" respectively. At the present time Schaudinn's classification is accepted by all workers with the notable exceptions of Musgrave and Clegg. The *Entamœba tetragena* of Viereck, once thought to be a different species, is probably identical with *Entamœba histolytica*.^{1 2}

It is well known that amœbic dysentery is a disease of tropical and subtropical countries but sporadic cases may occur in any climate. It would seem that it is more prevalent in Southwest Texas than is generally believed and without a doubt is more frequent in its occurrence there than is malaria or uncinariasis, despite the fact that the former diagnosis is a time-honored and much overworked favorite with many physicians. A careful examination of the stools of all cases with intestinal symptoms and of cases of obscure etiology without intestinal symptoms will establish the exact frequency of this disease, for it is to be remembered that frequent bowel-movements are not a necessary feature of amœbic dysentery. The diagnosis is made from examination of the fresh stool or material obtained by use of a rectal tube or scrapings from rectal ulcers. Particles of mucus and blood are more likely to contain amœbæ and at least 6 or 8 smears should be examined before a negative opinion is given. The presence of motile amœbæ in the stools is not sufficient evidence to justify a diagnosis of amœbic dysentery; the harmless *Entamœba coli* must be ruled out. The differentiation of this parasite from the pathogenic species can be made from differences in morphology and reproduction. For all practical purposes the diagnosis can be made

from differences in the appearance of the 2 species. The *Entamoeba histolytica* is larger and more actively motile; differentiation between ectoplasm and endoplasm is clearly defined; its pseudopodia are finger-shaped and its nucleus is absent or indistinct; it is phagocytic for red blood cells. On the contrary *Entamoeba coli* is small and sluggishly motile; endoplasm and ectoplasm are not clearly differentiated; its pseudopodia are blunt and its nucleus distinct; it is rarely or never phagocytic for red cells.

In recent years much has been written on the treatment of amœbic dysentery. No subject in the history of therapeutics has received such a diversified therapy as has this. Many drugs have been proposed for use by mouth and by rectal irrigations; among the latter may be mentioned quinin, sodium chlorid, ichthyol, boric acid, silver nitrate, potassium permanganate, formalin, hydrastis, coal oil, krameria, creolin, bichlorid of mercury, tannin and countless others—a formidable array. The fact that so many drugs have been recommended is a potent proof of the efficacy of none of them. Of the drugs administered by mouth, ipecac deserves more than passing mention. It has been used for years in India and the Indian physicians are enthusiastic in their praise of its virtues. The opinion of medical men generally is divided as to the real value of ipecac; the experience of some upholds the enthusiasm of English physicians in India, while others claim that the drug is “in no sense curative.” Certainly it has the disadvantage of provoking nausea and vomiting at times in spite of precautions, and some refractory cases are uninfluenced by it. Brown³ states that ipecac does positive harm during acute exacerbations and Musgrave⁴ has seen at least three cases in which death was directly attributed to the improper use of ipecac.

A more extended reference should have been made to the hypodermic use of emetine hydrochlorid, one of the alkaloids of ipecac. Vedder⁵, in 1911, reported his experiments with emetine. Wherry⁶ of Cincinnati, early in 1912, found emetine in dilutions of 1 to 20,000 and 1 to 200,000 to be amœbicidal in 24 hours. Rogers⁷ of Calcutta a few months later began using this drug hypodermically and his results have been most satisfac-

tory. Many confirmatory reports have since been published in this country and in England and France.

The present status of emetine I shall leave for those who wish to enter into the discussion, merely mentioning that a large percentage of the cases treated with emetine have become chronic carriers of encysted amœbæ and that frequent recurrences have been reported: Wagner⁸ treated 3 cases and had 2 recurrences 6 and 7 months later; Dopter⁹ had 10 recurrences out of 46 cases treated, 2 in 30 days, 3 after 3 months and 5 after 4 to 6 months.

My interest in the treatment of dysentery began with a case I saw with Dr. J. W. Nixon of Gonzales, Texas, about 3 years ago. At his suggestion Chaparro Amargosa was given to the patient with the most happy results. Since this time I have used it in 12 cases and am sure that it is the most efficient remedy we have at present for treating amœbic dysentery, unless we except emetine.

We are indebted to the Mexicans for the name "Chaparro Amargosa." It means "Bitter Bush." Botanically it is classified as *Castela Nicholsoni* Hook, and probably belongs to the *Simarubaceæ*, of which family quassia and simaruba are also members. Putegnat¹⁰ states that "that it is hardly to be distinguished from the entire-leaved plants of the *Simarubaceæ*," but places it in "the natural order *Ochnaceæ*."

Chaparro Amargosa has been a domestic remedy among the Mexicans of Southwest Texas and Mexico for many years. It is stated that General Zachary Taylor's soldiers learned its secrets during the Mexican War and profited no little from its use. The first attempt to bring this remedy before the profession was made by Putegnat of Brownsville, Texas, in 1883 (*loc. cit*). He studied the plant botanically and chemically and recommended it as an anti-periodic and incidentally mentioned that it had been used in cases of diarrhœa and dysentery. Nixon¹¹ of Gonzales, in 1893, emphasized the anti-dysenteric properties of the drug and established firmly its therapeutic value. He reported three illustrative cases and stated that he had had many others. Knox¹² one year later published a personal experience and felt no hesitancy in attributing his re-

covery to Chaparro Amargosa. West¹³ of Galveston made a preliminary report on seven cases in 1895, using the fluid extract; in his words "in every case under its use the frequency of the stools has diminished, the tormina and tenesmus subsided, the blood, mucus and amœbæ disappeared from the dejections. The patients left the hospital apparently cured after three to four weeks of treatment." Crittenden¹⁴ the following year cured a case of intractable dysentery of three years standing by using fluid extract of Chaparro Amargosa. From 1896 to 1913 the literature to which I have access is surprisingly free from anything on this subject. Indeed the above articles are all that can be found. It is not mentioned in the catalog of the Surgeon General's Library and there is no reference to it in the *Index Medicus*.

Chaparro Amargosa is a small thorny bush which is indigenous to Southwest Texas and Northern Mexico, growing on thin, rocky mesquite or post-oak land and having an especial tendency to be found on small, rocky hills. It grows to be a bush two or three feet in height, its size depending on the comparative richness of the soil on which it is found. Its leaves are small and lanceolate, its flowers pink and very small. The matured fruit is a red berry about the size of a pea. All parts of the plant, from the root to the berry, possess the characteristic bitter taste and medicinal properties.

This drug is on the market as a fluid extract, the dose being one to three fluid drams before meals. My experience has been confined principally to the use of the infusion, which is prepared by boiling the plant—roots, branches, foliage and fruit—in water for 30 to 60 minutes. No definite weight can be used, as the weight of the plant will vary with the seasons and with its dryness. The infusion should have the color of moderately weak tea.

My routine treatment is as follows: the patient is kept in bed if practicable; the diet is restricted to liquid and semi-liquid articles; an ounce of magnesium sulphate is given three or four hours before treatment is begun and repeated every 3 or 4 days; six or eight ounces of the infusion are given by mouth one-half hour before each meal; rectal enemata of 500 to

2,000 cc. of the infusion are given in the knee chest posture twice daily and the patient is instructed to maintain this position for five or ten minutes and afterwards to retain the solution as long as possible. The length of time the fluid will be retained varies with the irritability of the rectum and the persistence of the patient; in some it will be only a few minutes while others will be able to retain it indefinitely. If the large bowel contains fecal matter it is well to irrigate it with normal saline preliminary to giving the enemata. It is advisable to continue the treatment for a week or two after the subsidence of all symptoms.

The infusion as well as the fluid extract has an intensely bitter taste, but it is a "clean bitter," and no difficulty is experienced by patients in taking it. The bitter taste is easily overcome by eating a piece of bread or drinking a little coffee if necessary. As a matter of fact, the bitter taste is not undesirable because of its tonic and stomachic effect. No nausea or other untoward symptoms have followed the administration of this drug and so far as is determined it exerts no detrimental influence on the human organism, even in large doses.

The active principle of Chaparro Amargosa has not been satisfactorily isolated. Putegnat (*loc. cit.*) extracted from the root-bark an amorphous bitter principle of a resinous character, partially soluble in water and soluble in alcohol and ether, to which he gave the name "amargosin." But this work has not been substantiated. It is my personal belief that the therapeutic action depends on an alkaloid or a glucoside; however at the present time there is not sufficient evidence to confirm this belief. By some, tannin is accredited with the anti-dysenteric properties of Chaparro Amargosa, but this certainly is not the case: we have had prepared a de-tannated fluid extract, which is no less bitter and no less potent than the original fluid extract.

A few experimental observations are produced to uphold the amoebicidal action of Chaparro Amargosa. On April 19, 1913, Dr. Frank Paschal of San Antonio, Texas, evacuated the contents of a large liver abscess. Ten months previously this patient had dysentery for two weeks, at the end of which time

pain in the right hypochondrium, fever, chills and sweats developed and have persisted to the present time. In this pus, which had been present about nine months, were found large numbers of a very resistant strain of active *Entamæba histolytica*. These parasites lived at room temperature for several hours and some were still motile after 24 hours. A 1 to 10,000 dilution of the detanned fluid extract of Chaparro Amargosa at body temperature caused all parasites to cease moving instantly and to assume a spherical shape with sharp differentiation of ectoplasm and endoplasm; 1 to 100,000 dilution required 40 seconds to accomplish the same result and 1 to 1,000,000, 2 minutes. With a very weak dilution of 1 to 10,000,000, only one sluggishly motile organism was found after 6 minutes and this one soon ceased all motion.

A few experiments were done to test the action of Chaparro Amargosa on other amæbæ, but these I believe have no bearing on the subject. For instance, the *Entamæba soli* was found to be about 10 times as resistant as the *Entamæba histolytica*. One is no more justified in holding that a given dilution will destroy the *Entamæba histolytica* because it destroys free-living forms, than one is justified in stating that a given solution will render innocuous the anthrax bacillus because it so acts on the gonococcus.

This drug is not indicated in ordinary diarrhea and is probably without action in other parasitic intestinal infections. One case of *Strongyloides intestinalis*, one of *Balantidium coli* and 3 of *Cercomonas intestinalis* were uninfluenced by it. One case of the last-named was apparently cured; this patient gave a history typical of amæbic dysentery but as no amæbæ could be found, it was not so classified.

This communication is based on the treatment of 12 cases. Part of these were seen with other physicians, to whom I now express my indebtedness.

Case 1. O. V., farmer, age 43, first seen October 6, 1911. First attack. Onset 2 months ago with frequent and bloody movements and pain in abdomen. Was in bed for 3 weeks. Symptoms decreased for 3 weeks, but became troublesome 10 days ago; 6 or 8 bloody stools a day, tenesmus and pain in rectum. Appetite poor, nausea but no vomiting. Lost 40 pounds in weight. Various medicines; no effect.

Physical Examination. Patient looks ill; very anemic. Temperature 100, pulse 96. General examination negative. Proctoscopic examination negative except for slight congestion of rectal mucosa. Stools are mostly blood and mucus and have characteristic "fleshlike" odor. Many characteristic *Entamoeba histolytica*.

Treatment and Course. The day after treatment was begun, patient felt much better and had only one movement which contained mucus but no blood. No living amœba. One clump of what appeared to be dead amœba seen. At the end of a week, patient went home free from all symptoms. No recurrence 2 years later.

Case 2. H. L. R., farmer, age 55. First seen November 13, 1911. Second attack. First attack lasted 4 months. Present trouble has continued 3 months, two to twelve bowel movements a day. Extreme abdominal pain and rectal tenesmus. Has lost 20 pounds in weight. Symptoms not affected by silver nitrate irrigations or starch and laudanum enemata.

Physical Examination. Patient is very thin and anemic. Temperature 99, pulse 84. General examination negative. In the left iliac fossa one can feel the sigmoid as a tender elongated mass. No ulcers seen in the rectum. Stools semi-solid, yellow in color and flecked with blood and mucus. Moderate numbers of motile *Entamoeba histolytica* are seen.

Treatment and Course. This man was sent to the hospital where he spent a very restless night; morphia gr. ½ hypodermically was necessary to control the pain. He threatened to go home if something wasn't done. Chaparro Amargosa was begun the following morning and by evening he felt much easier and slept all night. No stools until the second day and then no living organisms could be found. On the morning of the second day the patient was found smoking a cigarette and said he felt better than he had for months. He went home at the end of a week, feeling well and having gained five pounds. A letter four months later stated that he had gained twenty-six pounds in weight and that he was free from all symptoms. No return two years later.

Case 3. D. F., refugee from Mexico, age 45, first seen December 6, 1911. Four attacks of dysentery in past year, each attack lasting 3 or 4 weeks. Symptoms: 8 or 10 bloody stools a day, pain in abdomen, tenesmus and loss of ten pounds. Injections of linseed oil, ichthyol and silver nitrate, and medicines by mouth have not modified the symptoms.

Physical Examination. Patient is rather pale and thin, slight general abdominal tenderness. Temperature 98.6, pulse 90. Stools are almost pure mucus, flecked here and there with blood. Many blood and pus cells and many motile *Entamoeba histolytica* are seen microscopically.

Course and Treatment. Treated with Chaparro Amargosa by mouth and by rectum. Patient did not have a single bowel movement except when injected fluid was expelled or when epsom salts were taken. No blood or mucus was seen and no amœba could be found. Reported 2 weeks

later and considered himself well. This patient is at present a member of President Huerta's cabinet and even under such exciting circumstances has not succeeded in precipitating a return of his dysentery.

Case 4. A. R., school boy, age 9, first seen December 24, 1911. First attack. Abdominal pain, tenesmus, blood and mucus in stools, 2 to 4 movements a day at intervals for 6 weeks. Paregoric and salts by mouth and ice water enemata have alleviated but not cured the condition.

Physical Examination. General examination negative. Stools semi-solid, containing blood and mucus; characteristic foul odor; microscopically, blood and pus cells and *Entamoeba histolytica* in large numbers.

Treatment and Course. Routine treatment. Injections retained for $\frac{1}{2}$ to 2 hours. No bowel movement except when fluid was expelled. Blood and mucus disappeared at once and no living amœbæ could be found after first treatment. Child gained 4 pounds in a few weeks and has remained perfectly well up to the present time.

Case 5. Mrs. E. M. H., age 62, first seen April 15, 1912. Symptoms of diabetes for several years. Eight previous attacks of dysentery in past 3 years, lasting 1 to 3 weeks. Very acute symptoms for ten days: 10 to 20 bloody bowel movements a day, tenesmus, abdominal pain and nausea.

Physical Examination. Patient acutely ill. Temperature 101.6; pulse 120. Urine contains sugar and acetone. Stools almost pure mucus and pus, flecked with blood. Many amœbæ.

Treatment and Course. Patient improved steadily from the first treatment. Bowels moved 5 times the first day, 3 times the second and only once on succeeding day. Temperature came down to normal following the first treatment and remained normal. At the end of the week, patient was up and about and felt well, though she still had sugar in her urine. No recurrence.

Case 6. A. R., Mexican man, age 29, first seen June 24, 1912. For 2 years, with only one intermission of three weeks, patient has had symptoms of dysentery: 6 to 20 bloody stools a day. Loss of 30 pounds.

Physical Examination. General examination negative except for slight tenderness in the sigmoid region. Stools semi-solid and contain much mucus. Moderate number of *Entamoeba histolytica* and a few *Cercomonas intestinalis*.

Treatment and Course. This patient went home and used the treatment himself. He returned in 2 weeks and reported that his recovery had been rapid and complete. No recurrence.

Case 7. A. L., Mexican man, age 22, first seen June 24, 1912. Acute bowel symptoms for three weeks; poor appetite, nausea, vomiting, 6 to 20 movements a day, severe intestinal pain, tenesmus, blood and mucus in the stools. Great weakness and loss of 20 pounds in weight. Bismuth and the usual anti-diarrheal remedies have done no good.

Physical Examination. Anemic, under-nourished man. Slight gen-

eral abdominal tenderness. Stool fluid consistency, containing much blood and mucus. Moderate number of active *Entamæbæ histolyticæ*.

Treatment and Course. Patient greatly improved after first treatment. No bowel movements till salts were taken. No motile organisms could be found. Patient improved steadily. Gained 2½ pounds in five days and had no further symptoms. He remained well for 3 months, when he was lost sight of.

Case 8. B. H., negro man, age 24, first seen March 3, 1913. Symptoms for 6 weeks: 6 to 15 bloody stools a day, pain in abdomen, poor appetite, malaise, fever and loss of 5 pounds in weight. No relief from usual remedies.

Physical Examination. General examination negative. Small stools passed in office contains much blood and mucus; a few characteristic *Entamæbæ histolyticæ* and a few *Cercomonas intestinales*.

Treatment and Course. Patient was begun on 2 drams of the detannated fluid extract of Chaparra Amargosa before each meal and he did not have a single dysenteric stool afterwards. He was seen 10 months later and felt as well as ever. No amæbæ or *Cercomonas intestinales* in stool. No recurrence.

Case 9. W. C. N., merchant, age 46, first seen June 4, 1913. Onset 4 years ago. He had slight dysenteric symptoms at Pleasanton, Texas, for 3 or 4 months. He went to Mexico and there became acutely ill; 5 to 20 bloody stools in 24 hours, high fever, sharp abdominal pain and tenesmus. He lost 35 pounds in weight. He was brought on a stretcher to El Paso, where he stayed in a hospital 3 months and received all sorts of treatment, including ipecac. He improved but was not cured. He has continued to have recurring attacks of dysentery which are likely to follow work or over-eating. Stools never free from mucus. At present the patient has 5 to 10 bloody stools a day.

Physical Examination. Patient is sparely nourished; complexion sallow; mucous membranes pale. General examination negative except that the sigmoid is palpable as a firm, tender mass. Stools yellow, liquid; no blood or pus. Moderate number of very active *Entamæba histolytica*.

Treatment and Course. Chaparro Amargosa was given by mouth and by rectum. Immediate improvement; one formed movement the first day and none the second; no pain in abdomen. Only one active amæba seen after treatment was begun. Patient says that for the first time in months he doesn't "have to run" when he gets up in the morning. Treatment continued for 2 weeks. At the end of a month he felt fine and had gained 8 pounds in weight. His bowels were moving once daily. No amæbæ could be found in the stools.

Case 10. W. G. L., carpenter, age 52, first seen January 1, 1914. This man had had dysentery for 18 months. His trouble began as a watery diarrhea, followed one week later by the passage of blood and mucus. At the onset he was having 20 to 25 movements in 24 hours. He had very

severe abdominal pains and tenesmus; was nauseated but did not vomit. The acute symptoms lasted 2 months, though he has never been free from symptoms; he has not had a normal stool since the onset. At the present time his bowels are moving 10 to 15 times a day; they moved 15 times yesterday. He feels very weak and is troubled much with palpitation of the heart. There has been a loss of 25 pounds in weight.

The tragic part of this case is that he is a poor man; he had seen many doctors, spent all his money, and his stools were never examined.

Physical Examination. The man looks thin and debilitated. Tongue coated. Mucous membrane very pale. The heart and lungs are negative. Abdomen slightly distended and tender over all. The sigmoid is markedly thickened and tender. Stool, passed in office, is almost pure blood and mucus and contains a great many active *Entamæbæ histolyticæ*.

Treatment and Course. The patient was given 8 ounces of the infusion 4 times a day by mouth and 1 liter per rectum each morning. The day after the first treatment he felt better than he had at any time since the onset. He was free from pain and tenesmus and had passed no blood or mucus. His bowels moved only 3 times the first day, despite the fact that he took an ounce of epsom salts, and once on succeeding days. A stool passed the second day was semi-solid and free from blood and amæbæ. This man was symptom-free from the very first; he gained 3 pounds in 2 days and went to work on the fifth day—something he had not been able to do in 18 months.

This magic result, however, was short-lived; he returned 6 weeks later with a recurrence. It developed that he had kept up the treatment only 12 days—less time than advised. He felt obliged to go to work, so he began driving a 3-horse, walking plow—much harder work than he was used to doing. He was treated with the fluid extract of Chaparro Amargosa and his symptoms ceased immediately. There has been no further recurrence.

Case 11. R. G., farmer, age 45, first seen February 19, 1914. He had a previous attack of dysentery 8 months ago. The present trouble has lasted 4 months, ushered in by acute symptoms of 2 weeks duration. His bowels have been moving 10 to 20 times a day and have contained blood and mucus constantly. He has lost 25 pounds in weight. He has had various treatments, most of which have aggravated the symptoms; enemas of oak-bark infusion gave a little relief.

Physical Examination. General examination negative. Stool is thin and streaked with blood and mucus. Microscopically there is much blood and pus and many motile *Entamæbæ histolyticæ*.

Treatment and Course. He was given routine treatment with the infusion. His improvement was immediate after the first treatment, no blood being passed thereafter. His bowels moved once or twice for the first few days and then once daily. No amæbæ were found in the stools.

At the end of 2 weeks he felt perfectly well and has gained 10 pounds in weight. No recurrence.

Case 12. B. D., school boy, age 13, first seen March 4, 1914. This boy for 3 months has had symptoms of dysentery: intestinal cramps, tenesmus, nausea and 5 to 10 daily bowel movements containing blood. He has lost 18 pounds in weight. His bowels have moved 10 times to-day.

Physical Examination. Examination is negative except for the presence of anemia and emaciation. A stool, passed in the office, consists mostly of blood and mucus and under the microscope many active *Entamæba histolytica* are seen.

Treatment and Course. He was given the detannated fluid extract of Chaparro Amargosa, taking one teaspoonful 4 times a day by mouth and one tablespoonful to 500 c. c. of warm water as an enema. He was treated in the office at 5 p. m. He reported the next morning and said he felt fine. He went to a picture show the night before and sat through the whole performance—an unusual performance for him. He had had no bowel movement since the treatment and was free from abdominal soreness. The treatment was repeated and 6 hours later he returned symptom-free to his home, where the treatments were continued. A letter nine days later stated that the boy was perfectly well and had gained 10½ pounds in weight. No recurrence.

To summarize: This is the report of 12 cases of undoubted amœbic dysentery of three weeks to four years standing; 10 were given the infusion of Chaparro Amargosa and 2 the detannated fluid extract; there was immediate cessation of the symptoms in all cases; one case disappeared from observation after 3 months; one case had been well for 10 weeks, one for 3 months, two for 1 year, one for 2 years, and five for more than 2 years; there was one recurrence in a case insufficiently treated; in only one case was a living amœba found in the stools after the treatment was begun; these cases averaged less than two days before the stools became normal; there were no liver abscesses or other complications; experimental data prove the amœbicidal action of Chaparro Amargosa no less surely than do the clinical results, the drug undoubtedly having an elective affinity for the protoplasm of *Entamæba histolytica*.

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NOTE—Since writing the above, Case 9 has recurred. I have heard that Case 10 has had some trouble, also, but it is not certain that he has had a recurrence.

CLINICAL REPORT OF THE ANTI-MALARIAL CAMPAIGN AT CUYAMEL.

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At the suggestion of his preceptor, Dr. C. C. Bass, the writer attempted an investigation of the malarial index of Honduras. Owing to certain errors—the principal one being the preponderance of patients among those examined—the results were not considered worth reporting.

The experiments suggested by Dr. Bass led, however, to an understanding of the situation, which resulted in the work reported below.

To the practical instruction received from Dr. Bass, to the suggestions for experiments, and to the patience with which he corrected the errors—sometimes rather elementary—are due the brilliant results attending the campaign.

The plantation of the Cuyamel Fruit Company, lying between the coast and the foothills, covers a strip of land over thirty miles in length, and of a variable width. The land not under cultivation is an almost impenetrable jungle, crossed by numerous small streams, and teeming with insect life of every description, including anopheles.

The eradication of mosquitoes from the plantation would require operations extending over the entire district, full police power, and resources of men and money beyond the reach of anything but a government. Owing to the fact that a large part of the work is done by contract laborers, not under the control of the company, who live in palm leaf huts of their own construction, and who frequently change their location, neither screening nor systematic quinin prophylaxis can be carried out.

Owing to the incomplete state of the railroad and to the prolonged absence of a Spanish-speaking physician, at the time that the work was taken over (January 26, 1914), the native population was practically untreated. In the hospital every

month there were several deaths from malaria. It was not uncommon to receive a message from a foreman employing 150 men, stating that he had about 40 unable to work because of chills and fever. There was no form of malignant malaria which was not frequently encountered. By May 2, 1914, 1,000 cases of æstivo-autumnal malaria had been positively diagnosed, by the microscope, and over 800 clinical cases were treated, there not being time enough to make examination of all the cases of chills and fever. Of these, 74 were cases of mixed infection, with tertian or quartan, or both. There were, during the same period, 24 cases of pure tertian and 4 of pure quartan. As the total number of employees was from 2,400 to 2,600, it is clear that, after allowing for changes in the payroll, over fifty per cent were infected with malaria.

The three recognized methods of preventing human infection—destruction of mosquitoes, screening, and universal quinin prophylaxis—were impracticable. The only alternative was to prevent infection of the mosquitoes. The possibility of this was suggested by two facts, which were demonstrated during the experiments proposed by Dr. Bass. First: *Plasmodium falciparum* does not produce gametocytes in sufficient numbers to be evident in the circulating blood, until at least two or three weeks after clinical symptoms have been manifest. *P. malariae* and *P. vivax*, on the contrary, often have many gametocytes in a specimen taken during the first chill. Second: contrary to the usual statement, the administration of quinin does not cause the appearance of gametocytes at an earlier date, nor does it cause an increase in their number. It is perfectly true that the proportion of gametocytes to other forms is increased under quinin; but this is due to the persistence of the already formed gametocytes and to the fact that the action of quinin does not prevent the development to maturity of the gametocytes, but does destroy the vegetative forms at an earlier date. Some of the experiments are briefly described at the end of this report.

From these facts, it is evident that, in any locality where the prevalent infection is with *P. falciparum*, the discovery of every case in the first week of illness, combined with such thor-

ough treatment of every patient that he will neither relapse nor become a latent case, must result, after some months, in the elimination of infected mosquitoes from that locality. With the other two plasmodia, the discovery must be much more prompt to accomplish any results.

During the first few months of the campaign, a considerable number of the patients failed to complete the full course of treatment; but after one relapse, or after a few weeks of the debility attendant upon latent malaria, a second exhortation never failed to induce the delinquent patient to carry out the full course.

The campaign, during the first few months, was so imperfect that it could apply only to æstivo-autumnal malaria.

From June 20 to October 1 an assistant was allowed; the railroad was completed, and it became possible to treat promptly every case of illness on the plantation, and to carry out the cardinal rule of tropical practice—to examine the blood and feces of every patient presenting. During this period, the effect of the campaign could be seen upon tertian malaria as well. The patient with quartan malaria does not seek medical aid until some time after the gametocytes have been present in the blood, and this form of campaign will never be effective against the quartan parasite.

The results of the campaign are as follows:

	<i>P. Falciparum.</i>	<i>P. Vivax.</i>	<i>P. Malaria.</i>
Jan. 26 to May 2—			
Pure	929	24	4
Mixed	71	61	13
Clinical	800		
June 20 to Oct. 1—			
Pure	102	43	2
Mixed	5	2	3
Oct. 1 to Oct. 31—			
Pure	6	0	3

Of the six cases of falciparum infection discovered in October, five were either recent arrivals in the camp, or had paid long visits in the malaria-infested towns of the vicinity. Only one case originated on the plantation.

In carrying out this campaign, over 200,000 five-grain capsules were dispensed. It is to the credit of the Cuyamel Fruit Company that the efforts of the medical department were encouraged in every way possible.

If such results can be obtained among an ignorant, illiterate, nomadic population, in the midst of a tropical jungle, with nearby settlements heavily infected with malaria, it would seem that in an enlightened community, with a stationary population, more or less screening of dwellings, and with at least the amount of mosquito eradication which is produced by the drainage and cultivation of land, that a coöperative effort by physicians to promptly diagnose every case of malaria, and to energetically instruct and reinstruct every patient in the necessity of a sufficiently long course of treatment, to insure against relapse or latency, ought to result in the complete eradication of at last the æstivo-autumnal form of malaria.

Relapse in Malaria.

One of the most distressing things to contemplate, in malarious regions, is the multitude of victims of the disease who suffer at intervals, take treatment only sufficient to overcome the attack, and, in the course of a few weeks or months, repeat the performance, and so on indefinitely. During all of this time their strength and resistance are deteriorating and various organs are becoming affected by the degenerations induced by the disease. Many of them at last reach a condition in which it is very difficult to cure the malaria, even with most careful and systematic treatment.

It is a sad commentary upon the efficiency of the instruction given to malarial patients by the average physician, that out of 200 white patients with malaria—all of whom had been treated by physicians, and most of them in the United States—not a single one had the slightest idea that it is either necessary or desirable to continue the use of quinin more than a few days after the disappearance of the fever.

There is no doubt that a large number of them were advised to do so, but the advice was given in such a casual manner that as soon as the patient had apparently recovered, he forgot all about it. It is necessary to spend at least five to ten minutes with each patient, dwelling upon this point alone. The physician should advise each patient of the serious nature of malaria; of the changes it causes in the body; the loss of strength

it produces, and of the almost complete certainty of relapse without persistent treatment. After recovery, the patient should be reminded at intervals, either by letter or verbally, of the necessity of continuing treatment. If tactfully done, this show of interest wins a firm friend, and is a good business investment.

Unfortunately, the dosage and duration of treatment necessary to insure against relapse are not certainly known. All that we have to guide us is the experience of careful workers who have treated large numbers of cases and have followed up results. Precision of knowledge on this point could be obtained only by a competent worker, residing in a malaria-free region, who could have a large number of malarial cases returning from infected points; who could control the treatment of these cases, according to different plans; and could make frequent examinations of all of them for at least a year after treatment.

The problem of the course of treatment which, when applied to large numbers of cases, will be successful in practically all, is quite different, and can best be solved by a comparison of the work of different observers, who investigate their results. As there are no doctors or drug stores within reach of the employees, the dispensary record gives us a very complete check upon relapses and also upon the thoroughness with which the instructions were carried out, and it is in the hope that our results may assist in the solution of the problem that this report is offered.

There are as many plans for the treatment of malaria as there are authorities. The general trend of opinion seems to be that large doses are no more effective than moderate ones, and that the treatment should be kept up for three months, in the average case. The plan followed here is as follows:

Preliminary laxative, usually calomel, to be followed by a small dose of magnesium sulphate.

Twenty to thirty grains of quinin bisulphate for two days.

Fifteen grains daily, for one month.

Fifteen grains twice a week for two additional months, in cases of astivo-autumnal infection.

Rest and light diet during the continuance of the symptoms.

Thorough and repeated instruction as to the necessity of adhering to above program.

Special indications are met, of course, as they arise. If quinin is productive of disagreeable effects, sodium bromide—15 to 30 grains—is given to overcome them. There have been very few cases in which a tolerance of quinin was not readily established. Special warning is given against indulgence in alcohol while under quinin therapy. Not only is nervous irritability accentuated, but an excited intoxication is produced by much smaller quantities of alcohol than are required to produce the same result when quinin has not been taken.

At the beginning of the work, about 100 cases were given tonics of iron, arsenic, strychnin, etc., in various combinations. It was soon noticed that the percentage of hemoglobin showed as rapid a gain in those who received only the quinin as in those who received the tonics also, and that the health and strength of the former seemed to be as quickly restored. We, therefore, do not give iron, etc., as a routine; but in any case which does not make satisfactory progress, or which does not reach at least seventy-five per cent of hemoglobin in six weeks of treatment, we seek the complication which is responsible. In most cases this is found to be hookworm.

In cerebral cases, and in cases in which severe vomiting precludes administration by the mouth, from 15 to 25 grains of a soluble salt of quinin, with an equal quantity of sodium bromide and enough sodium chlorid to make the solution approximately isotonic, are given intravenously in at least 600 c. c. of freshly distilled water. One such treatment usually permits of oral administration on the succeeding day. It occasionally happens that such a case is seen as when, owing to distance or other cause, it is impossible to make use of the intravenous method. When this transpires, recourse must then be had to intramuscular injection. We have always divided the dose into a number of injections in different localities—not more than three grains of quinin in any one place. The rapidity and certainty of action were incomparably superior when the injection was so divided. Five of the cases so treated are still here, and after six months have developed neither indurations nor abscesses. On the other

hand, we have had in this dispensary a number of cases of painful induration, or even abscess, following the method of injection, in one place, of massive doses of quinin, or quinin and urea (which is much used in Central America). Several of these patients had either relapses or reinfection with malaria, and all of them stated that the pain was not annoying until the treatment had been completed and after they had left the care of the doctor. The explanation seems to be that the prolonged local anesthetic effect of the quinin prevented the recognition of the damage until some time after treatment.

For oral administration, the bisulphate is used exclusively. Early in the work, careful comparison showed that in the average patient three 5-grain capsules of the bisulphate will produce a physiological effect equal to that of four capsules of the sulphate. In cases complicated with the diarrheas, so common in the Tropics, ten or twelve capsules of the sulphate can often be taken without producing any marked physiological effect. It seems, therefore, that for tropical use the bisulphate is not only more certain, but actually cheaper, on account of there being no waste.

Results as Regards Relapse.

Of the first 1,000 cases of æstivo-autumnal malaria, 420 left the service of the company within five months.

Of the remaining 580, from three to six months have elapsed since the completion of the treatment; 116 of these took quinin less than one month—of whom over 40 were white; 246 completed one month of treatment, but failed to return for the last two months; 218 completed the course as outlined.

After one relapse, it usually needed but little argument to convince the patient of the desirability of taking the full course. The results were as follows:

Duration of treatment—	Patients.	Relapses. .
Less than one month.....	116	116
One month.....	246	91 (37%)
Three months.....	218	0

There were 85 cases of tertian malaria, of which 24 were pure. The pure cases were advised to take one month's treatment of 15 grains daily. There have been three relapses of

tertian malaria. None of these took treatment longer than three weeks. Four cases who only followed the treatment for ten days have remained free from relapse. No case which took the full month of treatment has relapsed; but the number of cases is too few to draw conclusions.

There were no relapses of quartan malaria.

Experiments.

Following are brief reports of some of the experiments, upon which the campaign was based. A number of other experiments were performed, but, owing to lack of control of the patients, or to pressure of other work, were imperfectly carried out. So far as completed, the results agreed with those of the experiments reported below:

Experiment 1. To a patient with a severe double infection with *P. vivax*, an intravenous injection of 20 grains each of quinin and sodium bromide was given. No further treatment was administered for a week, and slides were taken at frequent intervals. About two hours after the injection, a typical malarial paroxysm occurred entirely different in degree and character from the slight fever which follows saline infusion. During the time intervening between the injection and the chill, the half-grown parasites were seen to take on a more rapid growth; the protoplasm to stain less intensely, the chromatin, however, staining well; the red cell to develop Schuffner's dots, then to break down. The cells containing gametocytes were not affected in this way. The chill produced was premature, and young ring forms did not increase in number in the blood a few hours after it. A small proportion of the cells containing parasites of the same brood failed to show these changes—the parasites developed to maturity, and a mild chill occurred at the regular time. This regular chill was followed by the appearance of an increased number of young forms. The number of these, as compared with other cases containing about the same number of schizonts, and studied before the administration of quinin, did not seem to be diminished.

The same changes were observed daily, throughout the week, with both broods of parasites. The merozoite did not seem to be

killed at the time of emerging, nor did the young ring-form seem to be affected. When about one-quarter grown, the parasite seemed to begin to grow more rapidly, to show more pronounced amœboid movements, and to stain less deeply in the protoplasm. When about half grown, the containing red cell developed dots and shortly after broke down. A certain number failed to show these changes and the proportion of these was greater each day. The cells which did show the changes, showed them as completely and promptly on the last day as on the first. At the end of the week, about 20 per cent of the cells containing the parasites were unaffected. The number of the gametocytes steadily but slowly decreased. Relatively to the vegetative forms, the number of gametocytes was rapidly increased.

The only theory which seemed to explain the results was: that quinin, in therapeutic doses, does not destroy the plasmodium, but so poisons the red cells that they are more easily acted upon by proteolytic ferments. The digestive ferment produced by the parasite finds a more easily split food supply, resulting in a more vigorous growth; but by the time the parasite is half grown, the amount of ferment produced is sufficient to destroy the red cell, resulting in the premature liberation of the parasite.

A red cell once poisoned by quinin remains in this susceptible condition, and the effect of one administration of quinin persists until the red cells have been replaced by new-formed ones. The gametocytes escape, because the slower growth and less active metabolic processes do not produce enough proteolytic ferment to destroy even the quinin-poisoned red cell. Quinin does not provoke the formation of gametocytes, because it does not produce an environment unfavorable to the development of the parasite; but, on the contrary, produces an environment which is too favorable. The action of quinin is, therefore, in accord with the general biologic law as to the appearance of sexual forms in greater number under conditions unfavorable to the development of the vegetative forms.

Experiment 2. A patient with a mild infection with *P. vivax* was treated exactly as in Experiment 1.

The results were identical, except that after five days all

parasites had disappeared from the circulation. It is needless to state that all of these patients were afterwards given full treatment, and were recompensed for the time and risk.

Experiment 3. The same as Experiment 1, with a recent case of infection with *P. falciparum*.

The ring forms were not altered in any way, but showed a steady decrease in numbers. After seven days, oral administration was begun, and after ten days no more parasites could be found. At no time were any crescents to be seen.

Experiment 4. An æstivo-autumnal case of two months' duration was given 30 grains intravenously, and, on his own account, took 40 grains of the bisulphate surreptitiously. He became violently delirious and, after the administration of morphia, passed into a stupor lasting twelve hours. The rapidity of disappearance was no greater than after an injection of 20 grains, and, after seven days, ring forms could still be found in the blood.

Experiment 5. A case of mixed tertian and æstivo-autumnal infection of three days' clinical symptoms was given 5 grains of quinin daily. Contrary to expectations, *P. falciparum* disappeared after six days, while *P. vivax* required twelve days for complete disappearance. No crescents were to be seen at any time.

Experiment 6. A case of æstivo-autumnal malaria, of three months standing, complicated with a recent tertian infection, was given the routine treatment. Daily slides were taken. *P. vivax* disappeared after five days; the ring forms of *P. falciparum* after 21 days, and a crescent was seen on the thirty-second day.

Experiments 7 to 23. Seventeen cases of æstivo-autumnal fever seen within three days after the appearance of symptoms were placed upon the routine treatment, and slides examined daily for at least a month. In fifteen of them, the parasites disappeared in from three to six days. In one, on the eighth, and in one, on the tenth day. In not a single case were crescents to be found at any time.

Experiments 24 to 70. Forty-seven cases of falciparum infection, with a history of clinical symptoms extending back a

year or more, were placed upon the routine treatment. The shortest time needed to free the blood from all parasites was three weeks. The average time was between six and seven weeks. One case, after three months of treatment, with all adjuvants including rest, salvarsan, diet, etc., still had irregular chills and showed many parasites in the blood.

Experiment 71. A recent case of tertian malaria was put upon routine treatment, and a daily total and differential leucocyte count made. The differential count included a simultaneous differential count of the gametocytes and active forms:

	Before Treatment.	Number of Days				
		1.	2.	3.	4.	5.
Polymorphonuclears	58	52	48	46	44	46
Large mononuclears.....	6	8	8	9	8	7
Small mononuclears.....	30	34	35	36	39	34
Eosinophiles	6	8	8	9	9	13
Basophiles	0	0	1	0	0	0
Gametocytes to 100 white cells.....	18	19	12	2	1	0
Vegetative forms.....	48	34	2	0	0	0
Total white cells.....	8300	6200	6100	6200	6300	6100
Total gametocytes	1494	1178	732	124	63	0

Summary of Conclusions.

Quinin in therapeutic doses does not act upon the plasmodium; but upon the red blood cell. It so poisons the cell that it is more susceptible to the action of the proteolytic ferments of the plasmodium, resulting in a premature liberation and destruction of the forms belonging to the cycle of schizogony. This effect persists after the elimination of the quinin, and is lost only by the replacing of the red cells by new-formed ones.

There is no time particularly favorable for the administration of quinin. It should be given as soon as possible after the diagnosis of malaria is made.

Moderate doses of quinin accomplish as much as large ones.

Quinin does not hasten the appearance of the gametocytes, nor increase, even temporarily, their actual numbers.

The length of time of treatment required to remove *P. falciparum* from the blood is proportioned directly to the duration of the infection; that is, to the age of the brood of parasites. In a very recent infection it is more easily caused to disappear from the circulation than either of the other plasmodia. One of the chief sources of error in diagnosis is the fact that a few irregular doses of quinin may so suppress this form in the circu-

lating blood, that a number of examinations are necessary to find it. On the other hand, a long-standing infection may require months of most careful treatment to remove the parasites from the blood.

The gametocytes of *P. vivax* and *P. malariae* appear very early in the course of the infection. The gametocytes of *P. falciparum* are not usually evident in the circulation until from three to five weeks after clinical symptoms have been manifest.

Nothing less than three months of systematic treatment can prevent a satisfactory proportion of the cases of æstivo-autumnal malaria from relapsing.

In any community, the prompt diagnosis and thorough treatment of every case of the infection with *Plasmodium falciparum* will result, after a few months, in there being no infected mosquitoes in that locality.

If the immigration of new cases be not too great, it is possible, by this means alone, to eradicate æstivo-autumnal malaria from a given district, even without the aid of mosquito destruction, screening, or systematic quinin prophylaxis.

NEWS AND COMMENT

New York is sending 2,000,000 units of tetanus antitoxin to Europe each month.

Dr. Isaac W. Brewer, Taughannock Falls, New York, has been appointed district sanitary supervisor.

Charles E. Davis, Jr., who was secretary of the Boston Board of Health for nearly forty years, died recently in Montreal.

Dr. Wilson G. Smillie, of Boston, has been made assistant professor of hygiene and preventive medicine at Harvard Medical School.

In order to concentrate the work of the Rockefeller Foundation, the International Health Commission will move from Washington to New York this month.

Two laboratories have been opened as branches of the Florida State Board of Health Laboratory, one at Miami and one at Tallahassee.

The Boston Milk and Baby Hygiene Association has five hundred more babies under its care this year than for a corresponding period last year.

Dr. Milton J. Rosenau, professor of preventive medicine at Harvard University, has been appointed pathologist to the Massachusetts State Board of Health.

Fifty physicians of Detroit have volunteered to give free medical service to destitute cases discovered by the Board of Commerce, of which they are members.

The age limit of district health officers has been raised from 32 to 36 years by the Public Health Council of the Massachusetts State Department of Health.

A new State Health Bureau was inaugurated in Minnesota in January, with Dr. Cornelius Williams, St. Paul, as president, and Dr. H. W. Hill, Minneapolis, as secretary.

The Union Traction Company of Indiana has issued an order that all employees must be vaccinated. Other large industries in the State are being urged to take a similar step.

The Indiana Legislature has adopted a resolution setting aside the first Friday in October of each year as disease prevention day, to be observed throughout the State of Indiana.

Dr. Milton J. Rosenau was elected president, and Dr. Francis H. Slack secretary of the Massachusetts Association of Boards of Health at its annual meeting in Boston, January 28.

The importation of animals or meat from certain countries has been prohibited by Italy because of swine plague, cattle plague and trichinosis. The principal countries affected are those of the Orient.

Passed Assistant Surgeon R. M. Grimm, United States Public Health Service, has been relieved from duty at the Hygienic Laboratory and has gone to Spartanburg, N. C., to take charge of the pellagra hospital there.

At the request of Dr. Simon J. Young, health commissioner of Porter County, Indiana, a sanitary survey of schools has been started in that county by Surgeon Taliaferro Clark, U. S. P. H. S., and five assistants.

The plan of the mayor of Boston to reorganize the City Board of Health as a single commissioner has been sanctioned by the City Council. The mayor's candidate for the office is P. A. Surgeon Richard H. Creel, U. S. P. H. S.

In an examination of the air from 220 cars in Chicago, carbon dioxide was found to be greatly in excess of the standard in 150 cases. Suits have been filed against these violations and also for the lack of ventilating fans in 128 cases.

The dining car and restaurant employees of the Pennsylvania Road, totaling 1,100, are examined monthly by the company's physicians. The kitchens and everything connected with them are examined regularly by traveling inspectors.

An exhibit of military hygiene and sanitation is being prepared by the Public Health Department of the American Museum of Natural History. Camp sanitation, personal hygiene and the health of armies will be dealt with, also bubonic plague.

Fourteen thousand dollars has been appropriated by the Bergen County (New Jersey) Board of Freeholders for the purpose of mosquito extermination. Last year only \$800 was appropriated and the sum was found totally inadequate for the work.

William J. Rogers, who devoted a great part of his life to the study of milk, along both commercial and scientific lines, and who was largely instrumental in starting the work of furnishing pure milk to babies, died in New Jersey on the first of February.

There is a bill pending in the Wisconsin Legislature prohibiting the use of cigarettes by any teacher in any educational institution in Wisconsin supported in whole or in part by public funds; also no diploma or certificate can be given by such an institution to a student who smokes cigarettes.

Dr. Charles Wardell Stiles, of the Rockefeller Hookworm Commission, delivered the ninth Weir Mitchell lecture of the College of Physicians of Philadelphia. His subject was "An Experiment from the Standpoint of Applied Zoology in the Medical Inspection of School Children as a Basis for an Intensive Public Health Campaign."

It was stated in a press news item published in this Journal last month that a leper colony was to be established in Minnesota. This statement is refuted in the *Journal of the American Medical Association* of February 20, by Dr. Henry M. Bracken of St. Paul, secretary of the Minnesota State Board of Health, who says there are only eight known lepers in the State.

Six communities in North Carolina have adopted the plan of health work of the Rockefeller Hookworm Commission. Almost every person in these six communities has been examined for hookworm and all those infected have been treated. Sanitary closets have been put into all homes, churches and schools and other sanitary changes have been made.

Owing to a ruling of the New York Department of Health that the heads of its departments shall not hold administrative positions elsewhere, Dr. William H. Park, director of laboratories, has resigned as dean of the New York University Medical College. He will, however, retain his professorship of hygiene and bacteriology in the college.

A sanitary conference has recently been held in Portuguese India, which urged the adoption of modern measures against malaria, tuberculosis and other preventable diseases. The Conference thought it highly desirable that municipalities should have complete control of the milk-supply or adopt a co-operative plan. Quackery and the secret remedies of India also received attention.

In his recent lecture in Baltimore before the Public Health Conference, Dr. W. C. Rucker, U. S. P. H. S., stated that Baltimore is taking great chances by refusing to appropriate money for a rat survey. The Federal government has offered to co-operate, but the city has refused to set aside any money for the work, though such an appropriation has been recommended by Health Commissioner Gorter.

A campaign for the prevention of unnecessary blindness has been started in New York and will probably be extended to other cities later. Co-operating are the New York Association for the Blind, the Illuminating Engineering Society, the Board of Education and the American Medical Association. The New York Association for the Blind has found that many cases of blindness could be prevented by proper hygiene, fresh air, exercise and good lighting.

The American Society of Tropical Medicine will hold its twelfth annual meeting in San Francisco, June 14, 15, 16, under the presidency of Capt. Charles F. Craig, M. C., U. S. A. All members are strongly urged to be present and are asked to communicate with Dr. John M. Swan, 457 Park avenue, Rochester, N. Y., who will also receive the titles of papers to be read at the meeting. All such papers will be published exclusively in this Journal.

At the annual meeting of the Society of American Bacteriologists held in Philadelphia, Dr. D. H. Burgey was elected president; John Weinzirl, vice president; A. Parker Hitchens, Glen Olden, secretary-treasurer; Dr. Milton J. Rosenau, delegate to the American Association for the Advancement of Science. A special meeting of the society will be held in San Francisco during the summer and the next regular meeting will be at the University of Illinois, Urbana.

Instead of plague being present in Chattanooga as at first reported, the disease was found to be a virulent form of smallpox, brought into Chattanooga undoubtedly by a man from El Paso. There were 56 cases of smallpox with 16 deaths between November and January 15. Dr. Richard H. Creel, United States Public Health Service, reports that there is no cause for alarm or prohibitive quarantine. Vaccination there and in other parts of the State is being extensively employed.

An elaborate program was carried out in Baltimore during the annual Health Week, February 8 to 13. There were one or

two addresses given each day, supplemented by lantern slides and moving pictures. There were also exhibits illustrating the public health work of blind and of insane persons, fraudulent medical advertisements, etc. Among the large number of prominent physicians making addresses were: Dr. Harvey W. Wiley, Dr. W. L. Rodman, Dr. J. C. Bloodgood and Dr. W. C. Rucker, the last giving a talk on "Menaces of Bubonic Plague and the Vaccin," illustrated by slides taken in New Orleans.

Public Health Activity.

FLORIDA—Health Notes, January, 1915. Many overlook the part that individual responsibility plays in public health. No man has a right to a dirty backyard, an unscreened privy or any other nuisance that will be objectionable or dangerous to his neighbors. The health of the community and town is dependent upon the health of each individual. Each death prevented, lowers the death rate of the city and State and adds that much to the end striven for by the boards of health. These boards work untiringly for the good of the people, but until each individual realizes and accepts his responsibility, there cannot be a perfect whole.

NEW YORK—Buffalo Sanitary Bulletin, January 31, 1915. Quoting from the London (England) *Medical Officer*, the following is given: "The National Anti-Vaccination League in the course of their campaign to hinder recruiting are pestering public men for their views on anti-typhoid inoculation. They sometimes get more than they ask for. A typical reply comes from the Dean of St. Paul's, who writes: 'I cannot imagine a more disgraceful or unpatriotic agitation than that in which you are engaged. If I were at the head of affairs I should have you shot summarily.' Widespread regret will be felt that Dr. Inge is not at the head of affairs."

NORTH CAROLINA—Health Bulletin, January, 1915. In these days everyone does believe or pretends to believe in fresh air, and yet how many are there who still hold the old idea that night air is not as healthy as that of the day. There are some who

complain that they can not sleep when the room is so cold and it is true that there is no more miserable feeling than to be too cold to sleep soundly and yet not cold enough to exert oneself to remedy the situation. If the proper clothes are worn and the proper covers provided, there is no reason that one should feel the slightest discomfort. After a few nights spent in the fresh, cool air, one will wonder how one ever slept otherwise. Whatever clothes and covers are necessary, get them, but above all open all the windows or sleep on a sleeping porch.

OREGON—Quarterly Bulletin of the State Board of Health, October, November, December, 1914. This bulletin contains a pamphlet on smallpox prepared by Jay T. Schamberg in connection with the Council on Health of the American Medical Association. Smallpox caused one-twelfth of all deaths in London in the eighteenth century. As Horace Wolpole wrote: "Poetry is as universally contagious as smallpox; everyone catches it once in a lifetime at least, and the sooner the better." There is also an old German proverb that says: "From love and smallpox but few remain free." Every stage and phase of the disease is discussed in the paper, as well as vaccination, immunity and control. But more appealing and convincing than all the excellent text, are the pictures shown. If this pamphlet is scattered broadcast among the public, surely those who now consider vaccination a worthless and foolish precaution cannot fail to see in it far more than they imagined.

CURRENT LITERATURE

THE SIGMOID FLEXURE IN HEALTH AND DISEASE.—Cantlie (*Jour. Trop. Med.*, 1914, XVIII, 1) contributes an interesting paper on the anatomy and the pathology of the sigmoid flexure. The paper is comprehensive and has applications alike for tropical medicine and for diseases of the temperate climates. When one examines the abdomen in the case of a tropical resident, who has had malaria or dysentery, all four corners must be explored. In cases of diarrhea the left lower (sigmoid) quadrant is the most important. It is possible by standing on the right side of the patient and palpating about one inch above Poupart's ligament, giving a sort of rolling motion to the fingers, to feel the sigmoid through the abdominal wall. When there is an extensive disturbance in this region the sigmoid may be firmly contracted and may feel as small as a lead pencil, or it may feel as thick as one's thumb. The pain and tenderness may point to the necessity of making a rectal examination. He suggests the term "*os sigmoidea*" for the point at which the sigmoid joins the rectum. He says that this region is similar in appearance to that of the uterus projecting into the vagina. He also speaks of this region as the "sigmo-rectal pylorus." Tenesmus is the most troublesome symptom of sigmoid disease and this symptom is explained by the slight invagination of the sigmoid into the rectum, which, in inflammatory states, protrudes more and more as the intensity of the disease increases. In chronic dysentery and in long standing mucous colitis, the most extensive point of the disease will be found at the junction of the sigmo-rectal pylorus and in the sigmoid, two inches above that point. He advocates the frequent use of the sigmoidoscope and the application of pure carbolic acid or the tincture of iodine to the ulcerated and inflamed surfaces. This should be followed by washing out the bowel with warm, natural or artificial sea water. He recommends the use of Crooke's *collosol argentum*. He gives castor oil in teaspoonful doses daily and passes the sigmoidoscope through the sigmo-rectal pylorus at intervals after the acute and subacute symptoms of the disease are relieved. He advocates a liberal diet.

John M. Swan.

THE WILD GAME AND HUMAN TRYPANOSOMIASIS; with Some Remarks on the Nomenclature of Certain Pan-African Trypanosomes.—Duke (*Jour. Trop. Med.*, 1914, XVIII, 13) furnishes a very interesting paper on the relation of wild game to human trypanosomes. There are two trypanosomes pathogenic to man: first, *trypanosoma gambiense*, which is susceptible to the action of human serum, and causes a chronic disease in oxen, sheep, and goats, and a relatively chronic disease in dogs and the smaller laboratory mammals; second, *Trypanosoma rhodesiense*, which is susceptible to the action of human serum and causes a more rapid disease in man and runs a more acute course in the laboratory and domestic mammals. Neither of these organisms appears to cause any inconvenience to wild game. In addition to these parasites, which are found in man, there exists in the wild game throughout the length and breadth of Africa, a host of polymorphic free-flagellated trypanosomes which, when introduced into domestic or laboratory mammals, cause an acutely fatal disease. These trypanosomes have various names: *Tr. ugandæ*, *Tr. brucei*, *Tr. pecaui*, or *Tr. rhodesiense*. These organisms show posterior nuclear forms. They are supposed to be nonpathogenic to man with the exception of the last. Reviewing the *Glossina*-carried trypanosomes in their natural state as opposed to those kept up by means of laboratory experiments, three main groups are easily distinguishable: the *vivax* group, characterized among other things by their uniform morphology; the *congolense* group of stumpy trypanosomes without free flagella; and the group to which both the human and the game trypanosomes above mentioned belong. During their development in *Glossina* each of the three groups behave in a characteristic manner. The *vivax* group affects only the proboscis; the *congolense* group affects the gut and the proboscis, and the polymorphic group affects the gut and the salivary glands. An exception is found in this last group in the *Tr. pecaui*, which has been described as occupying the gut and the proboscis. Too much confusion has resulted in classifying trypanosomes from insufficient attention to the natural conditions. The tendency to manufacture specific differences between strains of trypanosomes might be lessened if natural tests were depended upon more frequently. The author is of the opinion that in consider-

ing the diagnosis of any trypanosome the first test to apply is the test of its behavior in the *Glossina* host. The contention advanced by the Rhodesia and Nyasaland workers, that the wild game trypanosome is occasionally capable of surviving in man, depends upon the resistance of the individual. The great majority of human beings are probably immune; but if the exceptional human being is exposed to the exceptional human strain infection will result, so that when once man is infected it is possible that the human strain thus established may acquire pathogenic properties, which may survive through *Glossina*. The author would like to see all trypanosomes with a salivary gland anterior station, and with the animal reactions and the morphology characteristic of the game trypanosome of Yorke and Kinkhorn, described as *Trypanosome brucei*. The capacity for existing in man which characterizes certain strains of this *Tr. brucei* is sufficient to justify a distinguishing title; but until it has been demonstrated that this character survives transmission by *Glossina* from man to man, and not merely from game to an abnormally equipped human being, the author does not consider that *Tr. rhodesiense* can claim to be regarded as a good species. *Tr. brucei* var. *rhodesiense* better expresses the relationship involved.

J. M. S.

THE IMPORTANCE OF TERTIARY YAWS.—Howard (*Jour. Trop. Med.*, 1914, XVIII, 25) concludes that tertiary yaws is an important, destructive, and widely spread disease occurring in patients who have suffered from primary yaws. Many of its manifestations are practically indistinguishable from those of tertiary syphilis. Hence when yaws is known to occur in a community great care must be taken to eliminate its tertiary symptoms before pronouncing tertiary syphilis to be widely spread. Rhinopharyngitis mutilans and a special form of leucoderma of the palms and soles are, in many instances, symptoms of tertiary yaws.

J. M. S.

THE DISEASES OF HERRING FISHERMEN AND THEIR ERADICATION.—(*Die Krankheiten der Heringsfischer und ihre Bekämpfung.*) (Maring Staff-Surgeon v. Wilucki, *Archiv. f. Schiffs- und Tropen-Hygiene*, Bd. 19, No. 3, 1915.) The report comprises complete statistics of diseases and injuries which have occurred

among the herring fishermen of the North Sea, together with the treatment employed. It is very thorough and presents an excellent picture of the conditions at present prevailing and the means at hand for combating the difficulties. The maladies are those which in general occur equally as well among land inhabitants, and the remedies are the usual ones. The conclusions drawn by the writer from the investigations are that all things considered, the diseases are more severe than one would expect from the nature of the occupation. He thinks they may be effectually combatted by means of examination before starting on a voyage, by attention to cleanliness, clothing and drinking water, by the better stocking of the vessel with medical necessities, and the establishment of a hospital ship for fishermen by Germany, as Holland and France have already done.

L. C. Scott.

NOTES ON YAWS IN CEYLON, WITH SPECIAL REFERENCE TO ITS DISTRIBUTION IN THAT ISLAND AND ITS TERTIARY MANIFESTATIONS.—(Philip H. Bahr, *Ibid.*) The agricultural laborers of Ceylon are most commonly afflicted with the disease. It is as a rule confined to the lowlands, seldom being found among the population of the higher altitudes and especially the inhabitants of the northern and eastern provinces, as well as among the rice field workers of the southern parts of the island. The Sinhalese and Tamil laborers of the highlands are seldom afflicted. The elevation at which the disease appears to cease is about 800 feet, though syphilis is abundant enough. At this and higher elevations the hospitals contained no cases of yaws, but below at 400 feet almost every patient had scars. Housing, food, and clothing do not seem to play a part in the dissemination, nor does the common house fly, as Castellani thought. It would seem that some mosquito or other blood-sucking insect whose habitat is limited by either climatic conditions or vegetation may be responsible for the dissemination. The theory of contact is untenable.

The clinical manifestations consist of the primary lesion which is generally a small, hard papule on the buttocks. The secondary framboesiform rash was seldom observed. The tertiary lesions and sequelæ are the manifestations generally observed. These

consist of acute periostitis, which consists of a hot, painful swelling on the anterior border of the tibia. The chronic stage presents itself after the acute has subsided and hard periosteal nodes of considerable size may remain either on the tibia, the radius or the ulna. Diffuse osteitis resulting in saber-shaped extremities and badly joined fragments or fractures occur. Epiphysitis of the digits with consequent deformities, synovitis similar to that of the tertiary stage of syphilis accompanied by gummata and joint destruction, are fairly common. Ulcerations of large areas sometimes completely surrounding a limb and on healing leading to formation of cicatricial tissue, lymph stasis and elephantiasis of the extremities, may occur. Ulceration in the dorsum of the foot may lead to sinue formation resembling mycetoma. Gangosa, an ulceration of the nares, which the author attributes to the *Treponema pertenue*, occurs. L. C. S.

LXXX. OBSERVATIONS ON THE LENGTH OF TIME THAT FLEAS (CERATOPHYLLUS FASCIATUS) CARRYING BACILLUS PESTIS IN THEIR ALIMENTARY CANALS ARE ABLE TO SURVIVE IN THE ABSENCE OF A HOST AND RETAIN THE POWER TO REINFECTION WITH PLAGUE.—(*The Journal of Hygiene, Plague Supplement IV*, January, 1915.) A. W. Bacot describes experiments carried out on fleas allowed to feed on mice in the comatose stage of the plague infection, and confining them for various periods in cages covered with wax cloth. These were allowed to stand in a temperature varying from 35° to 65° for 18 to 73 days. When the period had elapsed two healthy mice were introduced into each cage. The results of the tests showed that fleas are able to carry the *B. pestis* for periods up to 47 days without a host; that the period between the ingestion of bacilli by the fleas and the infection of a new host may be as short as three or as much as 12 days.

LXXXI. FURTHER NOTES ON THE MECHANISM OF THE TRANSMISSION OF PLAGUE BY FLEAS.—(A. W. Bacot, *Ibid.*) It is pointed out how bacilli may accumulate along the spines of the proventricular valve and in this manner prevent its closing completely. The bacterial mass accumulating by reproduction after several feedings may, according to the figures, almost completely obstruct the valve. This is not dislodged completely during the suctorial movements of the œsophageal muscles and the

bacteria eventually come to lie in a distended proventriculus and pharyngeal tube. Consequent regurgitation into a wound produced by the proboscis of an insect, the proventricular valve of which is patent, may readily lead to the dissemination of the disease.

LXXXII. NOTES ON THE DEVELOPMENT OF *BACILLUS PESTIS* IN BUGS (*CIMEX LECTULARIUS*) AND THEIR POWER TO CONVEY INFECTIONS—(A. W. Bacot, *Ibid.*) The author remarks on the success of Verjbitski in communicating plague to guinea pigs by means of the *Cimex*, which had previously been allowed to feed on plague-stricken animals, the ear being the best site of inoculation. Besides this, virulence of the strain played a decisive rôle. Nuttall failed to convey the disease to mice by means of infected bugs. Jordansky and Klodnitsky found that the bacilli increased in the bug's stomach from the third to the sixth day. They could only be noted culturally after a period of 35 days. The same investigators found that two bugs of a batch of 13 survived for 83 days and the bacilli could be demonstrated in the contents of their stomachs five days after they had been allowed to feed on animals. The methods given by the writer of the article consisted of placing mice still in an active condition in a specially grooved box made by sawing cuts in a block bored with a one-inch hole. This arrangement prevented the mice from catching and eating the bugs, which they naturally do when unhindered. Young and old larvæ, nymphs and adults, were allowed to feed. Twenty-week old bugs were also infected. The net results of all experiments tend to show that in the majority the specimens became paralyzed and died, obviously from the infection. The smears taken from the stomach at various intervals of from 1 to 60 days and stained with Leishman's or carbol-thionin stains showed what Rowland has termed yeast forms, and that the bacterial content was dependent on the time and temperature of incubation. Even in the 60-day bug, there were shown, besides masses of coccus-shaped bodies, also bipolar staining bacilli. Bugs embedded in clove oil, celloidin and paraffin then stained with hematoxylin and eosin for tissues and carbol-thionin for bacilli did not give as good results as the smears. Several points could be noted, however. It could be

seen that bacilli tended to form in isolated clumps in the bug in contradistinction to the flea, in which the masses appear to fill the entire stomach. Infection of mice and rats with subsequent death followed in only two cases, one of which was doubtful. The bugs were allowed to feed through gauze spread on the shaved abdomen of the animal. The conclusions to be drawn are that a bug may infect an animal after 48 days' starvation, but that the majority of the bugs succumb to the infection themselves, especially newly hatched ones. The mechanism of infection seems to be by regurgitation of a poorly digested stomach contents due to incomplete closure of the oesophagial tube or by the washing out of clumps of bacilli by salivary secretion. Since bugs do not defecate after feeding, this characteristic of the flea may be eliminated as a possible means of transmission. The structural character of the blood is preserved for many days in the crop of the insect.

L. C. S.

SECOND PRELIMINARY NOTE UPON THE TREATMENT OF HUMAN TRYPANOSOMIASIS WITH SALVARSAN COPPER.—(F. van den Branden, *Archiv für Schiffs-und Tropen-Hygiene*, Bd. 18, No. 22, 1914.) Forty-three cases of trypanosomiasis have been treated by the author. The number of injections was variable, also the dosage. Generally one to three injections and 0.1 to 0.3 gram per injection were given. Some cases received more, even to four doses of 0.2 gram. The results seem to vary considerably, the blood remaining free from the organisms for periods varying from six months to fourteen months. The author concludes that salvarsan copper is an effective medicament, but its use as a prophylactic is not established. The sodium salt of salvarsan copper may, on account of the ease with which it dissolves, supplant salvarsan copper.

L. C. S.

SPRUE TREATED WITH EMETINE HYDROCHLORID.—(F. Schmitter, *Journal of the American Medical Association*, Vol. LXIV, No. 1, p. 53.) Twelve cases of sprue treated with $\frac{1}{2}$ to 1 grain injections daily of emetine hydrochlorid, one of which was complicated by amebic dysentery, have come directly or indirectly to the writer's notice. No case failed to respond to the treatment. A description of one case with remarkable results following a long series of failures in treatment, is given *in extenso*.

L. C. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

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REPRINTS.

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CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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No. 10.

EDITORIAL

The Cancer Problem.—In these days of activity in public health problems, several diseases are attracting general attention. Tuberculosis remains the chief among these and the question is one of so many phases that it promises a long campaign, educational and otherwise. The international project of the Rockefeller provisions in hookworm and other worldwide diseases has just begun to attract real attention and its future development is fraught with large possibilities—almost beyond present conjecture. The allied conditions of prostitution and venereal diseases are under the operations of a national society whose efforts have incited widespread legislative consideration involving marriage relations as well as the control of educational and institutional functions. Frequent sociological congresses constantly expand the public knowledge of borderland diseases of the body politic and the purposes of State health boards are

growing into broader relations to the individual and community health. Studies in racial proclivities to disease open up new ideas of effort and we are more and more aiming at a saner state of living. Leprosy at home has at last attracted attention from the National Congress and in another session provisions for victims of this disease in the United States may come about.

The large notoriety attached to the government control of radium has done much to bring the cancer question into public notice. Statisticians had already noted the growing prevalence of this disease and both scientists and philanthropists, working together, have used methods and money to discover the cause. Now the natural result has been reached, namely, that the time has come to study the ways and means of cancer prevention. Concerted action all over the country aims at a better knowledge of cancer and its occurrence as well as its early recognition, and the educational effort is also directed at the present and former neglect of this malady, with the idea of correcting this delinquency.

The average practitioner of medicine does not, or will not, recognize cancer early enough to benefit the victim. The physician's ignorance or neglect has hitherto helped largely to increase the growing mortality in this disease. Quacks have been many and ubiquitous in treating cancer and as yet the law has been slow to get on their trail. The recognition of the wholesome fact that the education of the people is the best means to remedy the evil is a long step towards good results. Public meetings with frank exposition of the symptoms, forms and remedy for cancer will do a great deal and if these are supplemented by each physician in every household of his practice, then the battle will be won.

Isadore Dyer.

ORIGINAL ARTICLES
PATHOLOGY OF VERRUGA PERUVIANA.
(Sixth Report)
From the Harvard School of Tropical Medicine.

By

RICHARD P. STRONG,

Professor of Tropical Medicine,

ERNEST E. TYZZER,

Assistant Professor of Pathology.

The distribution and description of the lesions as they occur upon the skin and visible mucous membranes has already been referred to at some length in previous papers. When the smaller papular lesions are removed, the tumors are seen to be rounded or oval. The cut surface is very moist, and serum and a variable amount of blood escape as the section is being made. In the most acute lesions the cut surface of the superior portion of the papule usually is of a bright cherry-red color, while at the base the tissue has a grayer appearance. Under a hand lens the cut surface of the papule appears moist, smooth, homogeneous, and very translucent. No blood vessels of sufficient size to be recognized with a hand lens are present, and no lobular appearance is observable.

Some of the larger lesions measuring from 1.5 to 2 cm. in diameter after removal present a different appearance. These may be rounded or dome-shaped. In the so-called mulaire lesions the skin covering the nodule sometimes resembles somewhat an onion skin. This appearance is given by the fact that the superficial layers of the skin have become slightly dry and the surface has become traversed by multiple longitudinal lines. These lesions after removal usually present a variegated appearance, being bluish, grayish, or purplish in color. On cut section through the middle of the larger tumors the surface is also moist, and serum and blood exude. The cut surface in general is dark cherry-red, traversed by longitudinal gray lines.

Sometimes yellowish-gray areas are seen in the substance with gray lines radiating about them. Under the microscope newly formed connective tissue is seen to occupy the areas in which the gray lines are present, and evidently gives rise to the appearance described. The yellowish-gray areas are seen microscopically to comprise the more compact cellular portion of the nodule. A few capillaries can be distinguished with the naked eye in the larger lesions. Sometimes the skin has become quite adherent over the tumor, and in the cut section in these instances some of the gray lines radiating from the surface evidently represent an invasion of epithelium into the depth of the tumor for a distance of several millimeters. The larger mulaire lesions sometimes show superficial ulceration and present then a reddened, moist surface. The appearance of these lesions is obviously somewhat modified by secondary infections with bacteria. Deep ulceration practically never occurs. .

The lesions occur upon the skin and visible mucous membranes, the lips, gums, conjunctivæ, and glans penis. In the description of the disease given in the text-books, one usually finds the statement that the eruption occurs in the internal organs. Thus Scheube¹ writes:

"There exists no mucous membrane or organ in which they may not appear, and the symptoms they can originate are remarkably manifold. Thus excrescences in the nose may cause epistaxis; in the throat and œsophagus, dysphagia; if situated in the larynx, cough, hoarseness, hemoptysis, and even suffocation may result; if they have their seat in the lungs, hemoptysis and infiltration may set in, which may be mistaken for tuberculosis; when situated in the stomach they cause hematemesis; in the intestine, diarrhea and intestinal hemorrhage; in the kidneys or bladder, hematuria; and in the uterus, metrorrhagia. In rare cases the brain and spinal column participate in the disease, inducing epileptiform convulsions and symptoms of meningitis."

The idea of the occurrence of the eruption in the internal organs appears to have been passed on in the literature from author to author since 1845 when Tschudi² in addition reported the occurrence of the lesions in the bones. In our opinion, the evidence given regarding the occurrence of the lesions of *veruga peruviana* in the internal organs is not conclusive. The

1. Scheube. *The Diseases of Warm Countries*, Lond., 1903, 2nd edit., 302.

2. Tschudi. *Arch. f. physiol. Heilk.*, Stuttg., 1845, iv, 378; *Oesterr. med. Wchnschr.*, Wien, 1846, 505.

anatomical changes that have been found in the solid viscera in this disease appear, frequently at least, to have resulted from complication with other diseases. Thus it is evident that the internal lesions of tuberculosis have sometimes been mistaken for those of verruga peruviana. The tissues of the organs from two of the cases, in which the diagnosis of Oroya fever and verruga peruviana had been made during life by the physicians who observed them, evidently came from individuals suffering with tuberculosis. This fact we were able subsequently to show from a microscopical study of the sections of these organs. We were also able to demonstrate acid-fast bacilli in these sections. During our stay in Peru in several instances, miliary tubercles in the spleen and liver, due to tuberculosis, were shown us by physicians as examples of the internal lesions of verruga peruviana. In our previous publications, attention has been called to the fact that Nicolle, Letulle, and Galli Valerio found acid-fast bacilli in the lesions of verruga, and that Darling observed at autopsy a case of verruga with generalized tuberculosis with lesions in the lungs, pleuræ, lymph-nodes, spleen, kidneys, and liver. Nicolle,³ in a case diagnosed as *maladie de Carrion* with internal verruga lesions found acid-fast bacilli resembling the tubercle bacillus in lesions in the liver, lungs, spleen, and lymphatics. Giant cells were observed in many of the tubercles. Bindo De Vecchi⁴ studied microscopically the tissues from two cases of verruga peruviana said to have shown at autopsy internal lesions. The tissues were sent to him from Peru. In the first case which had high fever during life a lymphatic abscess was said to have been present from which a paracolon bacillus was isolated. Regarding the second case no definite clinical information was furnished. In both of these cases in addition to the skin lesions De Vecchi found lesions in the liver, spleen, and lungs. These internal lesions consisted of nodules showing necroses with formation of fibroblasts and giant cells. The pictures of the internal lesions in the liver and spleen which De Vecchi illustrates are very different from the verruga lesions as we have observed them. He also observed bacilli present in

3. Nicolle. *Ann. de l'Inst. Pasteur*, Par., 1898, xii, 593.

4. De Vecchi. Beiheft 4, *Arch. f. Schiff-u. Tropenhyg.*, Leipz., 1909, xiii, 143.
Virchow's *Arch. f. path. Anat.*, Berl., 1908, xciv, Beiheft 1.

many of these lesions. During our stay in Lima, through the kindness of several Peruvian physicians, and particularly through that of Dr. Hercelles, we had opportunity of examining all of the pathological material present in the museum of the Dos de Mayo Hospital relating to verruga peruviana and Oroya fever. None of the lesions we observed in the internal organs were convincing that they were of a verruga nature. Only in two of the cases did it seem that there was any question as to whether the lesions were those of verruga peruviana. In one of these a small tumor, measuring about 4 mm. in diameter, was situated in the heart beneath the endocardium, and in another specimen from another case there were small miliary nodules in the pharynx and larynx. A description of the histological examination of the sections from these lesions has been given in previous papers. Microscopic examination of the one from the heart showed multiple cysts caused apparently by a cestodal infection. In sections of the other specimen from the pharynx numerous rounded masses of vascular tissue were present. There apparently was no tendency to caseation and no giant cells were discovered. No acid-fast bacilli were found in the lesions. It seems probable that these lesions in the pharynx and larynx represent those of verruga peruviana, and that an extension of the disease had occurred from the mouth to the pharynx and upper part of the larynx. No lesions were found in sections of the spleen from this case.

Histology.

In examining the literature we find that the histology of the verruga nodules of the skin have been studied by the following investigators.

Previous Investigations.

Velez⁵ expressed the opinion that the cutaneous verruga nodules originated in the papillary layer of the skin and mucous membranes. Dounon, Cornil, and Renault⁶ from the study of sections of the nodules concluded that they were of a fibrosarcomatous structure, being composed largely of embryonic connective tissue.

5. Velez. *Gac. méd. de Lima*, 1861, v, 198.

6. Dounon, Cornil, Renault. *Arch. de méd. nav.*, Par., 1871, 255.

Izquierdo⁷ described the connective tissue structure of some of the tumors, and noted their resemblance to sarcoma. He emphasized the vascularity of some lesions and mentions a true cavernous structure in some portions of others. He points to the great resemblance of these to the true cavernous angioma. He also noted the presence of non acid-fast bacilli in the sections.

Letulle⁸ observed subacute proliferation of the dermic and subcutaneous tissues, together with hyperplasia of the endothelial cells. In places the specific elements of the skin had disappeared entirely. The arteries and nerves remained intact. Other areas composed of lymph cells surrounded by a thin endothelial wall were also noted. Acid-fast bacilli were found in all of the lesions.

Nicollé⁹ examined histologically fragments of liver, kidney, lungs, spleen, and lymphatics, said to have come from a case of Oroya fever type in which there were only internal verruga lesions. In the lungs epithelioid nodules surrounded by leucocytes were present. There was no caseation and no giant cells were observed. In the liver, however, giant cells were found, but no nodules and no necrosis. The lymph glands showed caseation, and similar lesions were found in the spleen. Acid-fast organisms resembling the tubercle bacillus, from a morphological standpoint, were found in these lesions.

Hercelles¹⁰ attributed a vascular origin to the nodes, believing that they resulted from a periarteritic proliferation. The regression of the lesion was thought to be due to an endo-arteritic process. Sometimes giant cells were observed in the sections. He believed the substance of the verruga nodules to be formed from a reaction which resulted in the massing together of the tissue cells.

Escomel¹¹ believes that the organism of verruga is carried in the blood where it secretes its complex toxin. It is interrupted at points where the circulation is slow and where there is a favorable medium such as the skin for its development.

Leucocytes accumulate at this point, and a proliferation of the connective tissue cells occurs. Later an increased number of newly formed blood vessels appear. The typical verruga nodule is said to consist of verruga cells, "cellules verruqueuses" (formed from the connective tissue cells), few leucocytes, and a connective tissue framework. In some lesions many red blood corpuscles, leucocytes, and blood pigment were present. In the regressive ones the leucocytes were not abundant. He believes the verruga nodule belongs in the inflammatory group of lesions rather than among the

7. Izquierdo. *Virchow's Arch. f. path. Anat.*, Berl., 1885, xcix, 411.

8. Letulle. *Mem. Soc. de biol.*, Par., 1898, 764. Monograph di Odriozola, Par., 1898, 201.

9. Nicolle. *Ann. de l'Inst. Pasteur*, Par., 1898, xii, 590.

10. Hercelles. Thèse de Lima, 1900.

11. *Ann. de dermat. et syph.*, Par., 1902, iii, 961.

true tumors. Escomel also found bacteria present in many of the lesions which he studied.

De Vecchi¹² studied tissues sent to him from Peru which had been removed from three cases. The third of these was apparently a case of Oroya fever. No verruga nodules were found in the internal organs. The first case was complicated with pyogenic infection. There was high fever during life and swelling of the lymphatic glands. At autopsy the spleen was greatly enlarged, and in the submaxillary glands an abscess containing pus was present. There were also nodules in the skin and muscles, and tubercles in the lungs, spleen and liver. A paracolon bacillus was said to have been isolated from the pus of the abscess. Bacteria were found in the sections of the internal lesions by De Vecchi. These he refers to as bacilli of the typhus coli group. In one of the cases De Vecchi describes the lesions in the spleen as multiple necroses. Multinuclear giant cells were present which he states resemble the giant cells seen in tuberculosis. Some fibroblasts were present. De Vecchi does not believe, however, that the lesions were produced by the tubercle bacillus. Similar changes, but not so advanced, were found in the liver. In the lungs neither degenerative lesions nor giant cells were observed, but areas were present in the center of which the nuclei stained poorly. The reader should consult De Vecchi's article for the full description of these changes. Tubercle bacilli were not found in the lesions, but other bacilli single and in masses were present. In the second case it is stated that necrotic changes were present in the spleen, though of slight degree. The nodules in the liver De Vecchi characterized as typical of verruga lesions. Lesions were also found in the lungs which were partly necrotic, and a bronchial pneumonia was present. In the liver and spleen bacilli were found and in the lesions of the lungs cocci were in addition present. Acid-fast bacilli were not found. In the lesions of the skin and muscles the degenerative changes were not recognized, and giant cells were not observed. De Vecchi believes that the lesions in the beginning are simply of a hemorrhagic nature, and that later in such areas there is a proliferation of the connective tissue elements. He also believes that the necroses in the liver and spleen result from other hemorrhages from the newly formed blood vessels. The most striking characteristic to him, regarding the verruga lesions, was the presence of "globulifere" cells—cells formed by the leucocytes having engulfed red corpuscles. He also refers to the occurrence of "acidophile" bodies, measuring from 1.2μ in diameter which he believes probably originate from hemoglobin. Blood corpuscles which often stained poorly were observed near these areas. The verruga nodule he regards as of fibroblastic structure, a product of pre-existing elements in the tissues and the expression of the reaction of the tissue to an abnormal stimulus. A small number of mono- and poly-

12. De Vecchi. Beiheft 4, *Arch. f. Schiffs- u. Tropenhyg.*, Leipz., 1909, xiii, 143. Virchow's *Arch. f. path. Anat.*, Berl., 1908 xciv, Beiheft 1.

morphonuclear leucocytes were observed in the lesions. Newly formed blood vessels were almost invariably present in the smaller papules.

More recently Rocha-Lima¹³ had the opportunity of studying histologically lesions from the skin from a case of verruga peruviana observed in Hamburg with Mayer and Werner. He employed modern methods of technic, and his description of the histology of the disease in our opinion is the most accurate which has yet been given. He points out that the compact cell masses observed in the lesions were composed of the proliferated endothelial cells from the newly formed blood vessels, and that these cells should be designated as angioblasts. No giant cells were found. In spite of the superior technic, and of employing various staining methods, which included Romanowsky-Giemsa, Gram, and Levaditi methods, as well as tubercle bacillus staining, he was unable to observe either bacteria or protozoa in the lesions. On the other hand, within many endothelial cells as well as in the proliferated angioblasts from the blood vessels, he found conglomerations of fine granules which were not sharply bounded, and that only were clearly visible in the sections stained by Giemsa's and Levaditi's method. The position, size, form, and general appearance of these structures reminded the author greatly of the bodies observed in trachoma, molluscum contagiosum, birdpox, and other diseases in which chlamydozoa have been described. No proof whatever that the granules Rocha-Lima observed in the degenerating cells are parasites, is given. It seems remarkable that he should draw such sweeping conclusions regarding the etiology of this disease from the study of one case observed late in the course of the disease.

Finally Cole¹⁴ studied histologically the lesions of a case of verruga observed in Jadassohn's clinic in Berne, and also those produced in monkeys by inoculation with verruga material. He concludes that: "As the other granulomata—tuberculosis, syphilis, sporotrichosis, actinomycosis, etc., have their own significant histological changes, so also does verruga peruviana, belonging to the same class, have its own characteristic microscopical picture. It is characterized by a dilatation of the lymph vessels and a choking of their lumina with mono- and polymorphonuclear leucocytes; also by an infiltration around these vessels of plasma cells, fibroblasts, mononuclear leucocytes and relatively small numbers of polymorphonuclear leucocytes. It is further characterized by the formation and dilatation of a great number of blood capillaries and by an extravasation of much serum and many red blood cells into the tissues. The lymph vessels either rupture at an early stage or dilate to large dimensions when their cellular contents undergo a pycnotic degeneration and hyalin change, with destruction of the vessel and invasion of the mass by plasma cells and fibroblasts." The tumors examined from both the patient and the monkeys resembled each other so closely in their histological structure, and mode of formation, that

13. Rocha-Lima. *Verhandl. d. deutsch. path. Gesellsch.*, Jena, 1913, 198, 409.

14. Cole. *Arch. internal med.*, 1912, x, 668. *J. Cutan. Dis.*, N. Y., 1913, xxxi, 384.

Cole did not describe them separately. No giant cells were found in the preparations. Neither in smear preparations from the tissues nor in stained preparations of them was any parasite or organism found except secondary invading cocci and bacilli. Gram's, Gram-Weigert's, polychrome methylene-blue, tubercle bacillus stains, Mallory's eosin, methylene-blue, Mann's, von Krogh's method with polychrome methylene-blue, and Giemsa's stain were used. Cole does not refer to the presence of "chlamydozoa," but he calls particular attention to large cells lying in the center of the surviving lymph vessels which show signs of degeneration. In these the chromatic granules are first massed together in the nucleus; then deeply staining masses are seen in the protoplasm, while the latter begins to show signs of vacuolization and hyalin change, and the nucleus disappears. Finally the cell outlines themselves disappear and only the masses of degeneration products and hyalin are left. The endothelial wall about these large, degenerating, lymph areas remains intact at first, but later disappears when the surrounding fibroblasts begin to penetrate the mass.

Present Investigations.

During the time our studies in Peru were being carried on we collected a large amount of perfectly fresh verruga lesions of the skin for histological study. Lesions in the different stages of the disease from the very early to the very advanced ones were obtained. In this way we were able carefully to study the manner in which the lesions develop. The tissues were hardened in Zenker's solution, in corrosive sublimate and alcohol, and in Fleming's solution, or in formalin. Various stains were employed, including Wright's, Romanowsky-Giemsa's, Gram's, Levaditi's, hematoxylin, eosin, methylene-blue and eosin, Mallory's connective tissue stain, phosphotungstic hematoxylin stain, Scharlach Roth, acid fuchsin, and the tubercle bacillus stain.

We shall now attempt to give a general account, based upon the study of the tumors from the different cases, of the histological appearances of the lesions, showing the changes which they undergo as they progress.

The early lesions consist of newly formed blood vessels lying in connective tissue which as the lesion progresses in size becomes œdematous. The œdematous areas when developed are often very poor in cells, though at different stages of the lesion a variable number of lymphocytes, larger plasma cells, and polymorphonuclear leucocytes are present. The early papule is rich in blood and free blood cells are usually present. The newly

formed blood vessels are often very numerous, and a striking feature in regard to many of them is the small caliber of the vessel in comparison to the number and large amount of protoplasm present in their endothelial cells. In some instances the endothelial cells of the vessels form more than one layer, those on the outside continuing to proliferate. Sometimes the appearance suggests that a capillary vessel has become occluded, and swelling and proliferation of the endothelial cells has resulted. The nuclei of these cells sometimes shows mitosis. As the lesion progresses there is a very extensive proliferation of these angioblasts which give rise to large islands of closely placed cells in which the lumina of the small blood vessels become compressed and no longer visible. Only a few fibrils can be detected sometimes between the cells. In these areas and about their periphery small numbers of true fibroblasts may be made out. The prevailing type of cell in the early verruga nodule is the angioblast. Other writers, with the exception of Rocha-Lima and Cole, as we have intimated, refer to the prevailing type of cell in the verruga nodule as the fibroblast. Dounon and Izquierdo emphasize the fact that the nodules consist of a structure resembling sarcomatous tissue. Escomel assigns a specific character to these cells and designates them as verruga cells. Bindo De Vecchi insists that they are merely fibroblasts, while Cole describes the prevailing type as the plasma cell. A careful study of the very early lesions, however, seems to convince one that these cells are true angioblasts, a view also held by Rocha-Lima. This seems even more clear when one studies the staining reaction of these cells and compares these reactions with those of the endothelial cells of the small blood vessels, and also studies the progress of development of the lesions. In no other condition does one find such a striking and so characteristic a proliferation of the endothelial cells lining the blood vessels, as is encountered in the early verruga nodule, and it is this feature which particularly distinguishes the lesion from other pathological processes. Mitotic figures are numerous among these angioblasts. In the older lesions the fibroblasts have gradually invaded the island of angioblasts and deposited collagen fibres between them. In this way the nodules come more close-

ly to resemble a fibrosarcomatous structure. The verruga nodule, therefore, constitutes a special form of granuloma characterized in the early stages by the formation of new blood vessels in œdematous connective tissue, and by marked proliferation of the angioblastic cells forming masses or islands of closely placed cells, by the invasion of the connective tissue by lymphocytes, plasma cells, and leucocytes, and as the lesion progresses, by the formation of fibroblasts and the deposit of collagen fibrils.

The amount of connective tissue varies greatly in the different lesions, and also its characteristics. Sometimes elastic fibers may be demonstrated by appropriate staining methods. The number of long spindle cells is greater in the older nodules, giving them more a fibrosarcomalike appearance. The number and size of the blood vessels, and also the number of free blood cells, varies in the smaller and larger lesions. The amount of œdema is usually greater in the larger lesions. In the subcutaneous nodules, however, the lymphocytic infiltration is more marked. In the so-called mulaire lesions the epithelium has often disappeared and the surface is covered with a more or less organized blood clot in which a variable amount of fibrin, polymorphonuclear leucocytes, and round cells are present. Bacteria are also often present. Such lesions beneath the extravasation of blood often show a cavernous structure. In these areas the œdematous connective tissue is penetrated by thin-walled blood vessels of variable size. Often small extravasations of blood have occurred in these areas.

Thus, in the different tumors sometimes the condition found resembles somewhat a fibrosarcoma, sometimes a myxosarcoma, and sometimes an angioma. This seems to explain in part the differences in the descriptions which have been given of the lesions by other investigators. Apparently none of the previous histological studies have been based upon a very large amount of material. Usually only a small amount of material from single cases has been studied, or the report has been made from the study of a few pieces of tissue removed from a case which has occurred at a distance.

No giant cells were observed in the lesions which we have studied. Plasma cells were not found in the granulomatous

areas, but when present were seen more particularly at the periphery of the lesions in some instances, lying in the cedematous connective tissue. Mast cells were occasionally observed in the sections. The prevailing cell in the cell nests described above as constituting the compact portions of the nodules, as we have emphasized, is the angioblast. These cells are more or less flattened; the nucleus is large, vesicular, oval in shape, and does not stain deeply, being only moderately rich in chromatin; it often shows mitosis. These cells are sometimes found in various stages of degeneration, and are often vacuolated. They are the elements which Escomel refers to as "cellules verruqueuses," and which Cole refers to as cells of the lymph capillaries or plasma cells. Numerous phagocytic endothelial cells sometimes containing red blood corpuscles and cellular débris are often frequently observed in the tissues. These were described by De Vecchi as the "globulifere" cells.

As has been called attention to in other of our publications, no visible microorganism has been detected in preparations made from the unbroken nodules of the skin and in sections of the tissues. In those lesions in which the skin has become abraded bacteria and a few blastomyces have been found in the superficial portions of the lesion. Many degenerating endothelial cells have been encountered in the sections, the phagocytic cells showing at times extensive granulation, and with nuclei in various stages of degeneration. Mitotic figures, as emphasized, are also frequent in other cells. No bodies which definitely could be identified as protozoa or other microorganisms have been detected in the cells. The granular endothelial cells were much more commonly encountered in the lesions from monkeys than in those from human cases.

Angiofibroma Circumscriptum Contagiosum.

Reference has been made to the disease described in Brazil by Bassewitz under the title of "angiofibroma cutis circumscriptum contagiosum," and the similarity from a clinical standpoint between this condition and verruga peruviana has been pointed out in previous papers. Histological examination of preparations from the lesions of angiofibroma contagiosum have

been made by Unna,¹⁵ by Austrogésilo,¹⁶ by Jeanselme,¹⁷ and by Bennecke.¹⁸ All of these authors emphasize the presence of very numerous young capillaries in the tissue. One cannot fail to be impressed by the similarity from a histological standpoint of these lesions and those of verruga peruviana, particularly from the description of Bennecke. Rocha-Lima points out that the processes from the descriptions given do not appear to be identical, chiefly because in the telangiectatic granulomata the formation of vessels, and in the verruga lesion the growth of endothelial cells, appears to be the most characteristic appearance. However, Bennecke emphasizes the granulomatous nature of the angiofibroma contagiosum, the proliferation and new formation of capillaries, and the proliferation of the angioblasts. Whether true fibroblasts were present he was not willing to decide definitely. He suggests that the lesions are of an infectious nature and probably result from a living virus. It therefore seems evident that from a histological standpoint as well as a clinical one the disease angiofibroma cutis circumscriptum contagiosum, if not identical, is probably a very closely allied disease to verruga peruviana. Further observations upon this question are, however, desirable before a definite conclusion regarding their identity can be arrived at.

15. *Arch. f. Schiffs-u. Tropenhyg.*, Leipz., 1906, x, 204.

16. Austrogésilo. *Ibid.*, 205.

17. Jeanselme. *Rev. de méd. et d'hyg. trop.*, Par., 1906, iii, 124.

18. Bennecke. *Arch. f. Schiffs-u. Tropenhyg.*, Leipz., 1906, x, 297.

TRICHOMONIASIS OF THE VAGINA AND THE MOUTH.
Cultivation of the Causative Organism and Experimental
Infection.*

(A Preliminary Communication.)

By

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Incidence of the *Trichomonas vaginalis* and Question of Its
Pathogenicity.

The *Trichomonas vaginalis* Donné has been encountered in numerous instances and in many parts of the globe, in the acid mucus of the vaginae of women of various ages, occurring, according to some writers, always in connection with a vaginal catarrh and, according to others, sometimes in normal women. It has also been reported as occurring in the urethræ of men after cohabitation with women who harbored the parasite; and trichomonades, variously considered as identical with the *Tr. vaginalis* or not, have been encountered in the sputum and in the lungs of persons suffering from tuberculosis, gangrene, and putrid bronchitis (*Tr. pulmonalis* Schmidt, 1895), as well as in the stomach in a case of gastric cancer and in normal mouths. We have not yet had the opportunity of examining the original reports of these cases.

The organism has not been previously cultivated and attempts to transmit the infection to rabbits, guinea pigs, and dogs, have heretofore never been attended with success; nor is it understood how women become infected.

A great deal of confusion exists as to its relationship to the *Cercomonas hominis* Davaine, and to the *Trichomonas hominis* Davaine, or the *Trichomonas intestinalis* Leuckhart; in fact, the terms *Cercomonas* and *Trichomonas* are considerably confused by various writers.

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A difference of opinion also exists as to its pathogenicity, some believing it to be harmless, others considering it primarily pathogenic for man, while still others hold to the view that only as a contaminant to other infections it may assume importance.

The consensus of opinion seems to be that the *Trichomonades* found in the vagina, mouth, lungs, urethra, and alimentary tract, are one and the same organism, and that it may further excite already existing inflammatory conditions in various situations.

History of a Case of Infection of the Vagina and Gums and Description of the Parasite.

It was during the course of examination of a young negro woman (C. G.) in the Roper Hospital that we encountered a flagellate micro-organism in the mouth and subsequently in the vagina which we consider to be the *Trichomonas vaginalis* *Donné*.

This woman came into the hospital on December 15, 1914, suffering with pellagra and was referred to me for examination for the *Endameba buccalis* as she had an acute gingivitis. This inflammation of the gums was somewhat different to any form of pyorrhœa alveolaris that we had seen, being exceedingly acute, with soft bleeding gums, having ragged, saw-toothed, ulcerated margins which were unusually tender, and while there was some receding of the mucous membrane from the lower front teeth, there was none of the pus pocket formation and the teeth were in good condition. She said this acute condition had developed within the two weeks previous to admission to the hospital.

There was no diarrhœa nor had there been any; but there was a catarrhal vaginal discharge which she said commenced about two months previous with a profuse leucorrhœa accompanied by pain and burning on micturition. There was reported to be some slight vaginal ulceration when she was admitted.

She also had a slight cough, bringing up at times blood-tinged mucus, and was suspected of having an incipient tuberculosis of the lungs, no tubercle bacilli having been found in this sputum.

By microscopical examination of the bloody scrapings from the gums we found considerable numbers of the *Endameba buccalis* and, in addition, great numbers of very active flagellate organisms. These flagellates were also found in the sputum in small numbers.

Although at the time we counted these flagellates as probable contaminants, we studied them in detail and have done so on several occasions since. They were, when fresh and warm, very active, darting here and there in all directions, brushing the surrounding materials to the sides by some, at that time invisible means. In motion they were usually pear-shaped with the large end leading and although at times the shape was reversed and the head end became small, they never reversed motion. It was only when they slowed down or stopped, as they often did of their own accord, or became sluggish from exposure, that the form of the cells could be accurately studied. It could then be seen that the pear-shape was the rule, although they twisted and turned, elongated and shortened at will, and even protruded short blunt single pseudopodia at various points. They always had four flagella coming from the anterior end and frequently the attachment of these flagella to little knob-like blepharoplasts could be made out. These flagella were very delicate and uniformly about the length of the cell. When the parasite was stationary it moved in a whiplike manner, much as a driver cracks his whip overhead, at regular intervals, brushing surrounding materials toward and against one side of the cell where there was no distinct cytostome but a flat or depressed cell wall extending for the anterior half of the length of the body. Frequently solid particles, as bacteria, which were brushed against this part were taken into the cell, which observation was born out by stained slides. In active motion the flagella assumed a different movement which was difficult to follow, but seemed to be an overhand swimming motion, which was apparently the main means of locomotion of the parasite.

In addition to the flagella, there was a definite undulating membrane passing with decreasing sized waves from the base of the flagella in a rather direct line, along the side toward which the flagella brushed, to the tail. Its motion was apparently

started with that of the flagella, and when they acted in uniform rotation it was a continuous undulation.

The cytoplasm was finely granular but frequently contained coarse granules, corresponding to ingested bacteria in the stained specimens. Occasionally one or two, or as many as six, rounded non-pulsating vacuoles occurred in the cytoplasm, usually posteriorly but on some occasions bulging the cell outline at various points. These however were not constant nor even the rule.

The nucleus was very indistinct, of ovoid finely granular appearance, near the head.

The posterior end tapered, as a rule, to a blunt point and sometimes was prolonged into a short stiff tail which was not a flagellum but an elongation of the protoplasm, projected at will and used as an anchor. This tail was frequently drawn to a long delicate filament when the parasite pulled away from its anchorage.

The size of the cells varied considerably, from 10 by 18 microns or even smaller to about 23 by 30 microns, the average size being about 22 by 26 microns. When all motion ceased, as naturally after exposure for some hours, the cells became rounded, about two or three microns smaller, and the flagella usually lost. When they were suddenly killed they did not assume this form.

In specimens by Leishman's method the cells were slightly enlarged, as were the nuclei in proportion, a cell measuring 25 by 31 microns having a nucleus 10 by 12 microns, this being a little over the average size. One cell measuring 35 by 62 microns with a nucleus 13 by 17 was encountered in the vagina. With this stain the cytoplasm took a pale blue granular appearance, frequently with bacteria in small food vacuoles, while the nucleus was uniformly coarsely granular, had no definite membrane, was ovoid but with a slightly sharper end toward the head, stained red, and was within the anterior half. The undulatory membrane could be distinctly made out at times, and with long staining the four flagella were frequently brought out pink on pink blepharoplasts.

In specimens mordanted with iron-ammonia-alum and

stained with hematoxylin, the cell outline, the four flagella and, when the cell was in correct position, the undulatory membrane were all well brought out.

No encystment, no sporulation, nor division was seen, although in stained specimens occasional double nucleation was encountered.

Believing the parasite to be the *Trichomonas vaginalis*, we then examined the vaginal discharge and in addition to plentiful epithelial cells, a few leucocytes, and numerous nondescript bacteria, found large numbers of flagellates identical in form and properties with those in the mouth; as we have also seen in other cases in catarrhal vaginal discharges. This discharge was not profuse, was white and granular, and neither grossly nor microscopically purulent. There was no ulceration at our examinations.

As mentioned before she never showed a diarrhoea but on several occasions she was given a purge and examination of the feces on these occasions revealed no animal parasites.

Inoculation and Cultivation Experiments.

While we did not see any actual division of the parasites in fresh material, the divided nuclei observed in stained specimens led us to believe that under favorable conditions the organism might be artificially cultivated. Consequently we inoculated tubes of neutral bouillon, alkaline bouillon, bouillon and intestinal contents from various parts of the intestine, and acidified bouillon with material from the vagina and mouth, and incubated them at 37.5 degrees C. and at about 30 degrees. At the higher temperature no growth occurred and the organisms died in about twenty-four hours. In the acid medium considerable multiplication of the organisms occurred by direct division of the cells, the nucleus becoming larger as did also the cell, the nucleus splitting into two of equal size by hourglass constriction, and the two separating by an interval. The division of the cytoplasm began at the head as a depression, which increased in depth until the cell was split into two of similar appearances. The full course of the process and as to the disposition of the flagella and undulatory membrane we are not yet prepared to

discuss but expect to be able to outline the cycle in connection with a similar question very shortly.

This multiplication continued during the course of about three days (at which time we estimated they had increased about tenfold in numbers) in association with numerous bacteria; and a subculture was obtained from several of the original tubes, it also growing for about three days. After this period, probably because of the uncontrollable increase in bacteria, death of the organisms gradually occurred. No encystment was encountered in these cultures.

We are now in the course of further experimentation to determine still more favorable conditions for the propagation of this organism *in vitro*.

Our attempts at animal inoculation have, as yet, not been carried out extensively. We injected the contents of one of the culture tubes about three inches up the rectum of a white rabbit on January 3, and in three days the rabbit was passing soft brown stools in which plentiful trichomonades, which were not previously present and which were the same in form and properties as those injected, were found. The mild diarrhoea continues to the present and still shows the trichomonades. Further than this we have not yet had the opportunity of carrying the experimentation, but consider this success in the only case tried, in association with other evidence given in this communication and in another connection not yet brought out, as very definite proof of the pathogenicity of this organism, although we recognize that the route of infection probably will not conform to the natural.

Treatment.

Considering that the condition of the gums was probably endamebic, we put the woman on specific treatment for that condition, i. e., emetine hydrochlorid in $\frac{1}{2}$ gr. doses, given hypodermically daily. During this treatment there was absolutely no improvement and, although the amebæ were noticeably diminished in numbers in four or five days, the gums continued in the same condition, if not growing worse, throughout the treatment. which was discontinued after ten days' trial, we being then satisfied that the amebæ were not causing the acute condition.

For the next four days no treatment was given, we being occupied with testing the direct effect of certain solutions on the organism. There being then no improvement, we started alkaline washes, aiming at prevention of propagation of the trichomonades. A vaginal douche of saturated solution of bicarbonate of soda was given twice daily and the same solution was used to thoroughly cleanse the mouth and gums three times a day. After three days of this treatment there was only a slight exudate to be gotten by passing a curet into the vagina, the acute features of the gingivitis were practically gone, the gums being firmer, bleeding little, the ulcerated edges healing over, the redness gone, and the subjective symptoms very much improved. Only a few trichomonades were then to be found in either situation.

The condition of the gums having now been resolved into a mild pyorrhœa, the amebæ being present again in considerable numbers, she was again put on the emetine treatment, the alkaline washes being kept up in the meantime.

As this paper is being written, a week after the alkaline washes were instituted, the vaginal discharge and its trichomonades are gone, these organisms have disappeared from the mouth, and the condition of the gums is that of a mild chronic endamebic gingivitis, with a little receding of the gums, which are not ragged and ulcerated and tender, with a small amount of pus beneath the gum margins containing still the *Endameba buccalis*.

Summary.

To briefly summarize the information gained from the study of this case:

The woman suffered from a catarrhal vaginitis, in the discharge of which the *Trichomonas vaginalis* Donné was found, and which cleared up on the elimination of these micro-organisms by means of alkaline douches; also from an acute gingivitis from which the same organisms were obtained (probably from an autoinfection from the vagina), superimposed upon a mild chronic amebic gingivitis, the acute signs showing no improvement from a thorough administration of emetine but promptly disappearing upon the elimination of the *Trichomonas* by means

of alkaline washes, leaving behind the amebæ and characteristic signs of their ravages, which are now responding to the emetine treatment.

Consequently from pathologic and therapeutic viewpoints the vaginal catarrh and the acute gingivitis were due to the pathogenic activities of the *Trichomonas vaginalis*, whether predisposed to by previous local conditions or not; which clinical evidence receives strong support from experimental production of a *Trichomonas* diarrhœa in a rabbit inoculated with these organisms from a culture.

This artificial cultivation of the *Trichomonas vaginalis* *Donné* and experimental transmission of the infection to a lower animal is, so far as we can ascertain, the first success in either direction, and falls short of a definite proof of the pathogenicity of the organism only in that our cultures were contaminated with bacteria, which fault we have counteracted to some extent by failing to produce diarrhea in a control rabbit injected with a tube of culture in which the Trichomonads were killed by exposure to cold.

In addition we wish to say that the principles of treatment aimed at prevention of the propagation of the organism by means of alkalinization is apparently effective in *Trichomonas* infections.

**THE CLIMATE OF EASTERN NICARAGUA AND THE
HONDURAS, WITH NOTES ON THE HEALTH,
DEATH RATES, AND CHARACTER OF
THE COUNTRY.***

By

J. FRANCIS LEBARON., C. E.

Fellow American Association for Advancement of Science, Member American Society
of Civil Engineers, etc., etc.

The climate of the coasts of Nicaragua and the Honduras, bordering on the Caribbean Sea, has been much maligned by popular writers and even in scientific reports. It is the belief of the writer that this arises largely from ignorance and too hasty generalization, which it is the purpose of this paper to correct.

Having spent some six years in these countries, during which time I availed myself of the opportunity to take numerous observations of the temperature, rainfall, winds and climatic phenomena in general, and to secure copies of all records taken by others, I have embodied these observations in this article, which contains records for several stations in different places hitherto unobserved or recorded.

The result shows the error of assigning a climate to a large extent of country from observations taken in a few localities only, especially as these may be governed by exceptional local conditions, as in this case, where the character of the climate of the whole coast was based principally on the record at Greytown which has since been shown to be entirely abnormal (see Table I).

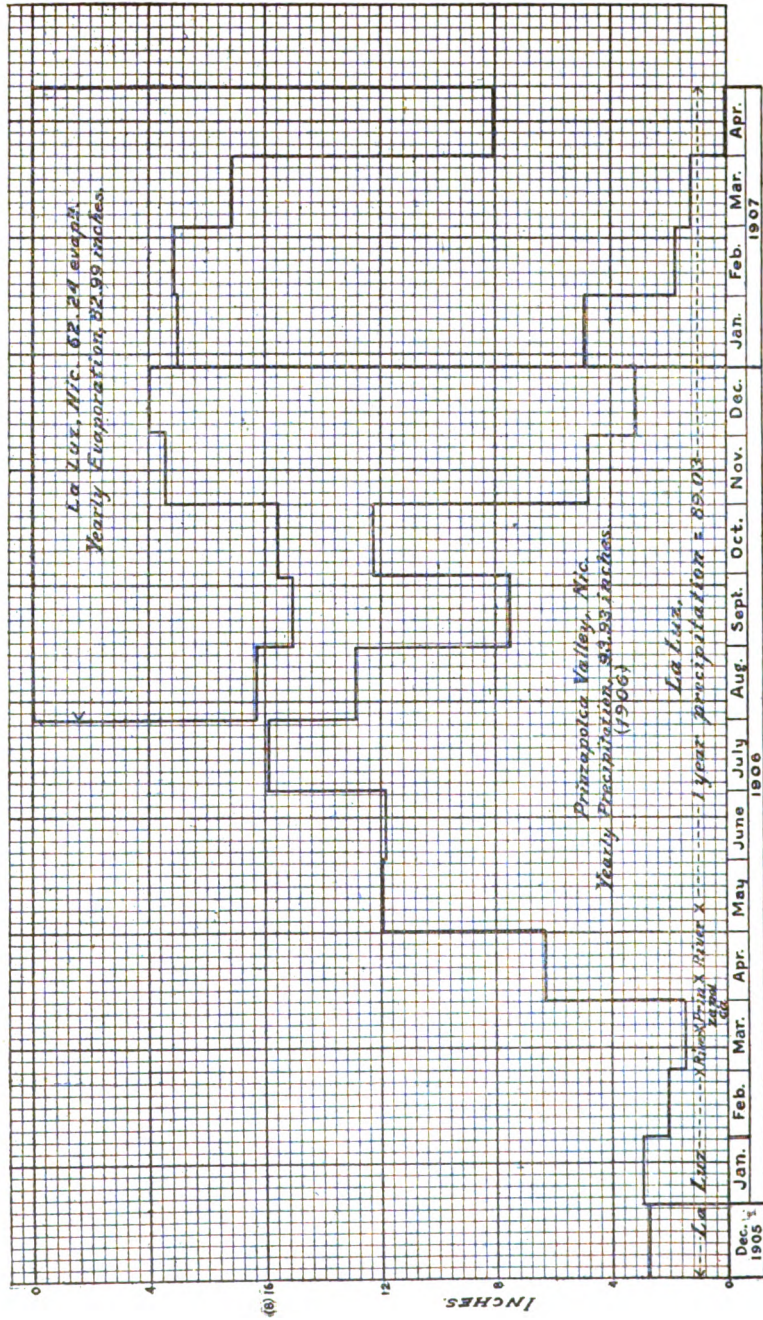
In the Tropics the difference in the rainfall between near-by stations is often very marked, as between Greytown, with an average annual precipitation of nearly 260 inches, and Fort San Carlos, on Lake Nicaragua, whose mean is 98 inches, the air line distance apart of the stations being but 70 miles.

*Read before the American Climatological and Clinical Association, Thirty-first Annual Meeting, Atlantic City.

(ORIGINAL)

J. FRANCIS LEBARON, C. E.

PLATE I



The same is true, however, in some northern localities; for example, British Columbia, where I found the precipitation at Ladner, at the mouth of the Fraser River, to be 36.88 per year, while at Lake Coquitlam, at the base of the mountains, and only 24 miles distant, it was 160.69 inches.

Even two gauges located in the same city will frequently be found to vary, as at New Orleans, where the United States Weather Service and New Orleans Drainage Commission have records taken about 5 miles apart and which differ over 50 per cent.

Nicaragua.

At Rivas, Nicaragua, the records kept by Dr. Flint for over 32 years differ from those of the United States Isthmian Canal Commission (observed only 6 months) from 21 to 53 per cent, although only about 300 yards apart. For this reason the Commission condemned the Flint record, which, in the light of fuller information, appears unwarranted.

The mean rainfall for 19 years at Rivas, as recorded by Dr. Flint, is 68.55 inches, and at Fort San Carlos, on the other side of Lake Nicaragua, 88 inches, as given by the Nicaragua Canal Commission, and the distance is 73 miles.

The fact that such great differences in precipitation exist in places so near together as those described above and those others shown in Table I, emphasizes the utter absurdity of designating the rainfall of a large extent of country by the observations taken in one locality only, but this is what has apparently been done in Eastern Nicaragua, which has been defamed with the Greytown climate, in spite of the fact, hitherto unknown, that the portion lying on the Coco or Wanks River has a rainfall of only about 75 inches, which is less than any place on the east coast. The observations at this place only cover five months, during which time they show 79.5 per cent. of the rainfall for the same months on the Prinzapolca river, distant 88 miles, so I have taken the annual rainfall as 79.5 per cent. of the Prinzapolca valley's annual precipitation. While the mean of the seven years observations at Greytown, which I inaugurated, show a rainfall at this place of about 260 inches annually, and Bluefields' mean of 4 years gives about 124 inches, the valley of the

Prinzapolca River shows but 94, and at the La Luz y Los Angeles mine, near Siuna, 89; while the Coco River valley on the northern boundary gives but 75 inches, or 29 per cent. of the precipitation at Greytown.

The character of the rainfall in the Prinzapolca valley, number of showers, rainy days, thunder showers, days without rain, excessive rains, rogs, winds, and evaporation, are shown in Table II, which is entirely original, while the temperature at the La Luz y Los Angeles mine, near the little town of Siuna, is given for 19 months in Table III, also original, which is supplemented by Table IV giving the temperature and humidity at Greytown for 2 years, which observations were inaugurated by me when in charge of the work of the ill-fated Nicaragua Canal.

Table V, of Bluefields rain, is made up from manuscript copies of observations taken by Mr. T. W. Waters, and Dr. Thorton, and given me when I was there in 1907. These are supply by observations published in the report of the Nicaragua Canal Commission.

It will be noticed that the record for the year 1900 is 147.95 inches as given on the manuscript notes of Mr. Waters. In the report of the Isthmian Canal Commission, 1899-1901, p. 184, this total is printed 127.63 inches. I have adopted the record 147.95, as being the original in the handwriting of Mr. Waters, although it is abnormally large. Table VI is another original table, constructed from the daily observations taken by my former assistant, Mr. Locke, and shows the precipitation in 5 months and 4 days in 1903, in the Coco or Wanks River valley, Nicaragua.

It also gives the number of showers and thunder showers during the daytime, with the temperature for the month of August.

Table VII is a copy of the weather on the east coast of Nicaragua, as summed up by Commander Pim, Royal Navy, from observations taken by himself during his stay on that station. It agrees very well with my observations.

TABLE II—Climate Observations in the Valley of the Prinzapolca River, Nicaragua, C. A., in 1905, 1906 and 1907

BY MR. AND MRS. J. FRANCIS LEBARON.
(Tabulated from the Daily and Hourly Observations)

(ORIGINAL)

Month	Fog and Heavy Mist	Rain & Shrt	Total Precipitation	No. of Rainy Days	Days and Nights of No Rain	Sprinkles	No Rain	Shr. Days	Fair and Clear Days	Thunder Showers	Squally and Gusty	Strong Gales	Light Wds to Calm	Northers	Direction of Wind	Cold Nights	Excessive Rainfall and Least do.	Hot Nights	Muggy Days	Heavy Nt Dews	Evaporation	REMARKS	
	(N. night D. days)	No.	In.	No.	No.	Days	No.	%	(N. night D. day No.)	No.	No.	Per Ct.	Quadrant	No.	In.	Time	No.	No.	No.	In.			
1905																							
Nov.		1		4	5		2	70														1 week obs. only	
Dec.	2 N 1 D	2	2.68	2	19	22	2	74	0	1			1	100								No thunder showers this month, three weeks obsns.	
1906																						No thunder showers this month. Rain comes up from East almost always two rainbows.	
Jan.	4 N 4 D	1	2.97	40	15	9	12	61	0	6			56	3	79	.4	20					Ex. rainfall, 4 in. in 20 min.	
Feb.	1 N		2.05	36	19	10	10	64	0	4			40		75	1.2	1 hr			1		On the 24 it blew a succession of squalls. Heat lightning 28 and 30. 2 water spouts off the beach about 200 ft. high. 5 thunder to North; 24 thunder; 30 thunder in P. M.	
Mar.	1 D		1.63	34	23	4	9	70					2	1	40							Thunder in night 18; thunder in P. M. 20; thunder in P. M. 21; thunder on the 1st. Brilliant lightning 9.	
April	2 N 1 D	5	6.57	51	17	8	13	60	1 N	4	2	50										Nearly every hard shower this month accompanied with thunder and lightning. Ex. prec. 1.05 in. in 15 min.	
May	2 N 1 D	5	11.98	50	11	3	14	70	2 N	1	1	68											
June	1 N 1 D	7	11.88	3	42	11	2	13	53	1 N	2	73		Var.		3 1.35 7½ hrs							
July	1 D	2	15.65	2	37	4	2	5	40	3 N	2	60				2.8 10 hrs. 1.05 15 min. .4 10 min.						7.52	
Aug.		1	13.06	2	32	10	6	10	30	6 N	1	80		N. W.	95							8.84	
Sept.		4	7.57	47	11	8	14	70	2 N	3		80		S. W.	45	.76	.44 21 min.						
Oct.		10	12.61	3	32	15	3	11	71	5 N	7	45		N. E.	45	2 4.00 24 hrs						1 8.43	
Nov.	1 N	7	4.85	3	29	15	8	7	35	1 N	2	40		N. W.	70	1			6			4.61	
Dec.		8	3.13	2	34	18	8	11	56	3 N	1	57				3			5			4.11	
1907																						Thunder 31.	
Jan.		16	4.92	4	45	11	10	15	60	1 N	3	80										4.98	
Feb.		6	1.74	34	18	9	14	78	1 N	5		75	2			5			3			4.94	
																						Rain clouds come almost universally from East this month. One thunder clap, 1st.	
Mar.	2 N	0	1.44	37	23	11	10	84		3		61		N. W.	61	{ Mar. 17 to Apr. 30			2			6.86	
														S. E.	23	{ Apr. 30 to Mar. 15						Cold raw day 7. Cloudy day 13. Hazy 6 days. Squally day 17.	
April	1 N	1	0.21	9	26	2	2	80		2		81		S. E.	32	{ Mar. 15 to Apr. 30			1			11.95	
														2 N. W.	20	7			2			Hazy. Sunset very red 10. Distant thunder 23.	
17 mos.	11 N	7 D 73.	104.94	21	261	273	105	174	66%	26	2 D 50	12	985		N. W.	78							Fair and clear days in 1906, 57 per cent
12 mos.	8	5	51.5	93.93	14.8	432	192.7	74.1	122.8	57	18.3	35.3	8.5	5.6	N. W.	81			7.8	7.1	13.4	82.99	Light winds to calm .. 57 .. Wind in W. W. Quad. .. 81 ..

39 per cent of the rain is in the night. 57 per cent. of the days are without any rain.

† During April at Prinzapolca the wind is generally west at night and works round to N. E. by 11 a. m., every day and blows very strong up to midnight.

‡ 3 weeks observation only.

N. B.—Observations at La Luz y Los Angeles Mines, Lat. N. 13° 42', 51' 51". Long. 84° 34', 15' W. Elev. above sea level 550 ft., May, Dec. 76, 52° E. all by observations of J. F. LeBaron, C. E., and Mrs. J. F. LeBaron, from Nov. 24, 1905 to Feb. 28, 1906. On the Prinzapolca River, Feb. 28, to March 17, 1906. At Prinzapolca, March 17 to April 10, 1906. On Prinzapolca River, April 10 to May 10, 1906. At L. L. A. Mines, May 10, 1906 to April 27, 1907. On Prinzapolca River, April 27 to May 5, 1907.

Temperature at La Luz y Los Angeles Mines.

Table III.

1905	TEMPERATURE				REMARKS
	Max.	Min.	Mean	Range	
October	85½°	72°	79°	13½°	Last half of month
November	85	67	82	18	26 days
December	86	66	68.8	20	27 days
1906					
January	86	62½	73.6	23½	25 days
February	87	63	77	24	18 days
March	86	69	79½	17	On the River 15 days and at Prinzapolca 22 days
April	90	70	79½	20	On the River 15 days and at Prinzapolca 22 days
May	90	72	81	18	21 days
June	90	71	79	19	28½ days
July	86	72	77	14	11½ days
August	88	71	78	17	16½ days
September	89	70	78	19	26½ days
October	90	70	80	20	30½ days
November	88	67½	77	20½	30 days
December	84	62½	72	21½	30½ days
1907					
January	84	65	76	19	31 days
February	84	61	75	23	28 days
March	87	67	76	20	30½ days
April	89	59	79.2	30	28 days

Max. 90°, Min. 59, Range 31.

N. B.—Observations taken 3 times a day at 7 A. M., 12 A. M., and 6 P. M., except the months of October and November, 1905, which were taken only twice a day, forenoon and afternoon. (ORIGINAL)

NOTE—Compare this table with the table of temperature of Greytown, Nic., published in the report of the Isthmian Canal Commission, Sen. Doc. No. 54, part 2, 57th Cong. 1st Sess., p. 197.

MR. AND MRS. J. F. LeBARON, Observers.

Nicaragua, C. A.

Temperature and Humidity.
Greytown, Nicaragua.

Table IV.

MONTHS	TEMPERATURE			Mean Relative	REMARKS
	Max.	Min.	Mean	Humidity	
1899					
January	86°	69°	77.8°	87.3 ^b	This table from report of the Isthmian Canal Commission, from observations taken on the Nicaragua Canal is inserted for purposes of comparison. (57th Cong., 1st Sess. Senate Doc. 54, part 2.
February	88	66	77.2	87.7	
March	90	72	79.7	80.9	
April	91	70	80.6	78.0	
May	98	72	81.0	84.0	
June	89	74	79.5	85.4	
July	88	73	78.7	86.2	
August	88	72	78.0	87.4	
September	90	73	79.3	86.6	
October	88	72	80.3	84.2	
November	88	73	78.2	88.6	
December	85	70	76.0	88.2	
1900					
January	87	71	77.4	87.0	Min. 66°
February	89	71	78.6	85.0	Max. 98
March	89	71	78.3	83.0	
April	94	70	81.7	80.8	
May	93	74	81.2	85.6	
June	92	75	81.1	83.2	
July	91	73	78.6	87.8	
August	89	75	80.0	86.2	
September	92	74	80.9	84.8	
October	91	73	79.3	87.8	
November	88	72	77.2	89.8	
December	86	71	78.6	84.2	

Mean Humidity 85°.4.

Summary of Rainfall.
Bluefields, Nicaragua.

Table V.

YEAR	TOTAL INCHES	
1884	1.99	April, mean of 1884, 1885 and 1900, T. W. Waters, Signed.
1885	97.72	Entire year, Report Nicaragua Canal Comm. '97-'99, p. 281.
1886	81.53	" " " " " " " " " "
1886	5.57	Feb. and Mch. " " " " " " " " " "
1899	64.78	Sept. Oct. Nov. and Dec. (T. W. Waters, Signed M. S.)
1900	147.95	Thomas W. Waters, (MS. signed copy). Entire year.
1901	7.20	January T. W. Waters, (MS. signed copy).
1905	88.08	May, June, July and August (Dr. Thorton, Bluefields.)
Mean	494.82	
	123.70	An. Mean for 4 years

N. B.—This table gives three entire years, the 4th year being made up by using monthly observations of other years.

Observations On Coco River.

Cabo Gracias à Dios, Nic. C. A., taken for the telegraph line between San Ramon and Locos River, during construction of the line by Calvin Campbell S. Locke.

(ORIGINAL)

1903.

Table VI.

MONTH	Days	No. Showers	Inches of Precipitation	Time A. M.	Temp. Fa. Not Used	Temp. Fa. Used	Time P. M.	Temp. Fa. Not Used	No. Thunder Showers	REMARKS	Elevation above sea under 100 ft.
July.....	26	74	4 days 1.76	Not Used	71° to 76°	71° to 76°	0.10 to 10.40	74° to 83°	43	Began number of showers and thunder July 6 Began rainfall record July 28, 4. { 116 } 3 distant thunders, Therm. in sun { 122 }	
August.....	31	83	8.50						18	1 distant thunders.	
September.....	30	62	9.87						9	6 distant thunders.	
October.....	31	53	8.67						5	4 distant thunders.	
November.....	30	63	4.86						0	5 days omitted in rainfall record.	
December.....	30	33	0.88								
	178	368	32.78						75	Precipitation per year 74.67 inches.	

Precipitation for 24 hours. Number of showers and thunder showers taken for working hours only.

J. F. LEBARON, Consulting Engineer, U. S. & N. Co.

Table VII.

The following is a short monthly extract of the usual weather met with on the coast of Eastern Nicaragua, recorded by Commander Bedford Pim, R. N.

January—Strong breezes from E.N.E. and N.N.E.; dry weather; occasional showers, principally during the night. Northers may be looked for this month, but are not common.

February—Squally weather, wind changes from N. to E. in sudden gusts; this month is sometimes showery, the wind never shifts beyond N. or E.

March—Strong breezes from E.N.E. About the 20th the equinoctial gale from N. to N.W. may be expected, but it has been known as late as the 7th of April. It is, however, sure to come and blow with great violence, generally for three days. The rain during the gale comes down in torrents, otherwise March is a dry month.

April—Light S.E. and S. winds with calms; no rains. In this month the lagoons are very shallow, the river at this season being very low. Great quantities of fish are taken; they come in shoals from the sea, which, owing to the lowness of the rivers, loses its muddy characteristics and becomes a bright transparent green.

May—Calms; dry weather; winds very light and variable.

June—Very heavy thunder and vivid lightning, with a deluge of rain; generally calm but subject to violent squalls and sudden gusts.

July—The same as June, but varied by strong, steady breezes from E.N.E. to N.E.

August—The same as the two preceding months, with the addition of very heavy squalls of short duration.

September—Calms and light, variable winds; thunder and lightning, with occasional rains.

October—The northers commence in this month, generally about the 15th; heavy northerly or northeasterly gales may be expected, with rain and squalls. Northers may be looked for at any time between October and March, sometimes even until April. During a wet month the weather is cold and thoroughly unpleasant, like a November day in England; but should the month be a dry one, it is both healthy and invigorating, and looked upon as a great blessing by the inhabitants.

November—Similar weather; plenty of rain; sometimes the trade wind blows uninterruptedly and the entire month passes without a norther.

December—Passing showers, the trade winds blowing strongly, occasionally interrupted by northers; not veering to N.W. as usual, but remaining steady at N.

Rainy		Dry.	
June.		January.	
July.		February.	
$\frac{2}{3}$ August.		March.	
$\frac{1}{2}$ October.		April.	
November.		May.	
December.		$\frac{1}{2}$ August.	
The rain descends in a perfect deluge, accompanied sometimes by dreadful thunder and lightning.		$\frac{1}{2}$ October.	
		Sometimes not a drop of rain falls, but generally in these months the weather is like an English April, except that the raindrops are heavy tropical ones.	

The signs of a coming norther are as follows: Dead calm, sea smooth as glass, tide very low on the shore; northern horizon banked up with heavy clouds; faint bluish sheet lightning. Before the norther can come the N.E. trade winds must be completely killed, to use a native expression; hence the calm. The above phenomena will give from three to eight hours warning of the approach of the storm, during which time every preparation must be made, as the gale appears to come on at once and knocks up a tremendous sea immediately. At night the stars shine with great brilliance, just as they do on a frosty night in high altitudes. The longest time a norther has been known to last is three days. The weather is generally clear and dry, parching up everything, but in a wet month the rain descends in torrents.

British Honduras.

Meteorological observations have been kept at Belize, British Honduras, since 1848, and possibly before, and it seems strange that these have never been quoted or discussed in any of the United States Government reports on the various canal surveys across the Isthmus.

When in Belize in 1898, I secured copies of as many records as possible and have supplemented these by other records obtained from various sources, and have embodied them in this paper, not only for their own value as adding to the sum of our knowledge of the climate of the region—British Honduras being but 35 miles from Spanish Honduras—but also as an aid in my discussion of the climate of Spanish Honduras, of which very little is known.

In Table VIII, I have given two columns of annual rainfall, one from the paper of M. W. Harrington, published in Bul. Vol. XIII, Philosophical Society of Washington, 1895, and the other column from the writings of Pim, Gibbs, and Dr. Hunter's observations and the record at the Observatory of St. Joseph's, Belize. The differences appear to be due to careless copying or proof reading, except in the case of the year 1888, where the difference between Dr. Hunter's and the St. Joseph Observatory is 19.33 inches, which is probably due to the observing stations being located in different parts of the city, as noted in other cases on the first page of this article, the difference in this case amounting to 21 per cent.

Rainfall at Belize, British Honduras, Coco River and Honduras Coast.

Table VIII.

Year	Total Inches	Total Inches	REMARKS
1848	47.20		Commander Bedford Pim, Royal Navy—"Gate to the Pacific."
1863	54.12	53.20	Archibald R. Gibbs in British Honduras.
1864	77.87	78.80	
1865	71.67	75.30	
1866	67.40	67.90	
1867	88.84	88.90	
1868	60.00	59.80	
1869	86.30		M. W. Harrington in Bul. XIII, Philosophical Soc. Washington, D. C.
1878	105.49	105.30	Dr. Alex. Hunter, Colonial Surgeon of British, Honduras.
1879	91.24	91.30	N. B.—The 1st column is the record from Commander Pim, Gibbs and Dr. Hunter, and the 2nd column from Mr. W. M. Harrington's paper, which seems to have been carelessly copied, as the decimals are given in tenths only, and sometimes are omitted altogether.
1880	77.74	77.60	
1881	91.46	91.30	
1882	63.14	63.00	
1883	79.38	79.40	
1885	88.93	89.00	
1886	69.26	69.30	
1887	100.16	100.20	
		72.20	Hunter { At the observatory of St. Joseph's, Belize, for this year the record is 72.17—Mean 81.81.
1888	81.84	91.50	
Yrs. 18	1402.04		

Mean 77.89 Mean of 18 years at Belize.

74.67 Mean for 1 year at Coco River, Dept. Cape Gracias à Dios.

76.28 Mean for 1 year at Honduras North Coast. (aprox.)

The following remarks by Dr. Alexander Hunter on the climate of British Honduras are valuable in this connection.

The Climate of British Honduras.

By Alexander Hunter, Esq., late Colonial Surgeon of British Honduras.

The characteristic features of the climate of British Honduras during the greater portion of the year are a most equable temperature, with strong easterly breezes in the summer months or dry season; an absence of rain for three or four months from the end of January; and in the winter months cold northerly winds, which are generally dry and bracing; and land winds, fortunately not continuous, which usually bring a great deal of moisture from the neighboring collections of water, and much rain. Exposed to the full influence of the trade winds, the whole coast may be considered as unexceptionally healthy during their continuance, while the temperature does not vary more than 6 or 8 degrees during the twenty-four hours. The atmosphere is dry—indeed, it would be difficult to point out any place in the West Indies in which the humidity is so inconsiderable. During the rainy season, the commencement of which is variable, there are sometimes short periods of calm, in which, although the temperature is not appreciably heightened, the feeling of heat is great; but, fortunately, these calms are of rare occurrence and of short duration. The rainfall is variable; but from observations extending over a period of twenty-five years, the general average for a year is found to be between 40 and 50 inches.

The only diseases are intermittent and remittent fevers and liver affections, and these are generally of the mildest description. The climate is such that a healthy European will undergo as much fatigue and exposure without being affected by it as he would in his own country; and where ordinary care is taken, a moderately good constitution may resist the effects of climate for a long period of years without experiencing even the smallest degree of sickness. The mortality among them is small, and, apart from special causes, they can show a degree of healthiness equaling, if not surpassing, that of their own country. Some years ago, while troops were regularly stationed here—and although the sanitary arrangements for soldiers in those days were different from what they are now—they enjoyed good health; and perhaps they never were stationed anywhere in any of the colonies—more particularly in the West Indies—where sickness and mortality among them were so little. Typhus and typhoid fevers are unknown and continued and low fever but rarely met with. Rheumatism is troublesome in the lowlands.

The mean temperature of Belize this year was 80 degrees, the maximum 92 degrees, and the minimum 58 degrees, giving a range of 34 degrees. But if we take the average of the maxima, 88 degrees, and of the minima, 71 degrees, the range is only 17 degrees, which shows a wonderful evenness of temperature, compared with that of other coun-

tries, where the thermometer varies sometimes 40 degrees in a single day.

The wind most constantly blowing came from the first quadrant. Beginning with the E., it veered to the N.E., and then to the N. The N.W. wind, as coming from the land, blew generally during the night. We had a S.E. wind for several days in some months, but a S., S.W., or W. only on some very few occasions. The force of the wind is, ordinarily speaking, not great, averaging a velocity between 4 and 7 miles an hour. During squalls, however, the velocity becomes very high. The highest velocity noted in our observatory was 25 miles an hour.

The rainfall, as in most tropical climates, is very great. This year (1888) it was not so heavy as in preceding years. We had 120 days of rain, with 72.17 inches, whilst Dr. Hunter's observations record as much as 91.50 inches. In Belize, on one occasion, we had over 6 inches in 24 hours. Throughout the year there was more or less of rain; but looking at the number of days on which rain fell, February, March, and April may be characterized as dry months, and the months from August to November as the most rainy ones.

Generally speaking, British Honduras is a tropical country, the temperature ranging from 56 degrees to 96 degrees, and averaging from 75 degrees to 80 degrees.

With these data and the observations on the Prinzapolca and Coco rivers, we are enabled to make an approximate estimate of the rainfall and temperature of the intermediate coast of Spanish Honduras.

Spanish Honduras.

Up to this time there have been no rainfall records taken in Spanish Honduras, except a short one at Tegucigalpa, as far as I have been able to ascertain, and except some unsupported statements as to Comayagua and San Pedro Sula, which I have included herein, for what they may be worth.

The records taken by my assistant, Mr. Locke, of the United States & Nicaragua Co., on the Coco or Wanks river (Table VI), which river is the eastern boundary of Honduras, are the only consecutive records that I have been able to obtain, of the north coast of Honduras, and they are here presented for the first time.

It will be observed that there is a fairly regular gradation, in the precipitation, between Greytown and Belize, namely:

Greytown	260 inches
Bluefields	124 inches

Prinzapolca Valley.....	94 inches
Coco Valley.....	75 inches
Belize	78 inches

Taking the mean of the last two would give for the intermediate stretch of coast a precipitation of about 76 inches, which from my experience there seems to be reasonably correct, although it is quite possible that there are restricted zones where the fall is much greater, such as some of the larger river valleys.

The statements made to me in Comayugua, that rainfall at that place was: minimum 42 inches, maximum 132 inches, appears reasonable, but great doubt is thrown on it by the additional statement of a fall of 36 inches in 16 hours, which is preposterous.

The statement by the same person of the rainfall of San Pedro Sula in 1895, 230 inches, does not seem reasonable, judging from my personal experience there or at Puerto Cortez, about 50 miles away, and moreover, I noticed irrigation ditches within 12 miles of the former place, which would certainly not appear necessary with such very extreme rains.

I would not have given this matter so much space were it not that my informant was a well-known English civil engineer, living some 20 years in the country, and our information of the rainfall of Honduras is so meager that every item in regard to it is seized with avidity. Of course, however, such statements could never be used in any discussion of the hydrology of the country.

In the following pages I have collected such facts in regard to the temperature and general climate as I have been able to discover in a somewhat extensive search through various publications concerning the country, and have supplemented these by my own observations while resident in the country in charge of various interests and engineering operations for American companies for several years.

The statements of Mr. Wells agree perfectly with my experience, therefore, I have thought it best to reprint it in his own words.

Meteorological Notes on Honduras.

(William V. Wells, New York. Harper Bros. 1857. p. 540 et seq.)

Nature, as if unsatisfied with her lavish gifts in other respects, has dispensed to inland Honduras a climate not excelled by the most delightful regions of California. For the greater part of the year the mercury ranges between 69 degrees and 85 degrees Fahrenheit, the changes of the season so gradually ordered that the transitions from winter to summer, consisting in an alternation of dry and showery weather, is scarcely perceptible, and attended with few or none of the effects noticeable in the temperate zone. The four seasons are thus simplified into two, the rainy and dry. The former, announced by infrequent gusts of rain and heavy clouds, commences about the first of May, and continues until the middle of November. It should not be understood, however, by the term "rainy season," a constant fall of rain, the change of season in this respect being somewhat similar to that of California. The wet months of Central America are in reality the pleasantest, not only from the verdant aspect of nature, whose wooded and floral beauties are developed by the rains, but from the peculiarly bracing atmosphere experienced in the mountain districts at that time.

The dry season, in Olancho, commences, as usual, in November, but for geographical reasons and the topography of the country, rain falls at intervals until the middle of March. One of the heaviest thunderstorms I saw in Central America occurred on the 13th of February, 1855. The rains come up with a southerly and easterly wind, and generally fall in the afternoon, though in the wet months proper the mountain storms sometimes rage with great violence all night.

The "chubaseo," or afternoon squall, may be depended on during the rainy season. The double-headed clouds heralding its approach are unmistakable, whether in the interior, marshaling with lowering front along the rugged peaks of the Cordilleras, or on the coast, rolling up from seaward, glimmering with lightning, and muttering distant thunder. In the winter these storms burst upon the traveler unannounced, and in an incredibly short time swell the mountain streams into impassable torrents, as quickly subsiding with the passing of the tempest. These are succeeded by intervals of warm sunshine, imparting a freshness to the landscape, which in its smooth, undulating character and sober woodlands, often recalls the finest portions of New England scenery, with the soft but invigorating climate of Jalapa, Puebla, or the City of Mexico. There is scarcely any season on the Caribbean coast when the climate is uncomfortably cool except during the violent northers, when the mercury has been known to descend to 60 degrees Fahrenheit; but in the mountains, the weather is often so cold, from December to February inclusive, that fires are necessary for comfort; hailstorms, one of which I have already alluded to, are recorded, and in Salto, Santa Lucia, Cerro de Ule, Nueva Arcadia, and particularly in the elevated districts of Gracias, the cold is such that

many of the inhabitants descend to the valleys until the return of more genial weather. In Tegucigalpa, at an elevation considerably over 3,000 feet above the sea, the thermometer ranges from 56 degrees to 70 degrees in the morning, from 72 degrees to 80 degrees at noon, and from 70 degrees to 78 degrees in the evening, from November to March inclusive. This shows an evenness of temperature leaving little to be desired. At Jutecalpa during the winter months, I found the climate to differ but slightly from that of Tegucigalpa, notwithstanding its lesser altitude.

A thermometrical table, kept during my journey, shows the range of the mercury from the summer of 1854 to the spring of 1855. It exhibits a difference of temperature between the coasts and the uplands of the interior as marked as that existing between the temperate and torrid zones. During the period passed in the interior of the country, the lowest mark of the thermometer was 52 degrees, and the highest 88 degrees Fahrenheit.

Recapitulation.

A careful study of the foregoing tables disclose the following facts:

Temperature.—The highest temperature (Fahr.) observed during the 2 years, 1899 and 1900, at Greytown, Nicaragua, was 98 degrees in May, and the lowest 66 degrees, in February. This gives a total range for that interval of 32 degrees. This is the highest observed thermometer anywhere in the region under discussion. In Table XXVI, the temperature of Goascaran is summarized as 106 degrees at 2 p. m. in March and April by a mine owner living there, but this place is on the Pacific slope and does not properly enter into this discussion. Moreover, this is only an unsupported statement.

The following comparative table (No. XXIX) gives the maximum and minimum temperature and ranges, the annual rainfall, mean humidity, days of no rain, fair days, winds, direction, number of showers per month, and number of thunder showers per year, at the different places treated of in this paper.

A careful study of this paper shows that Greytown is 6 degrees hotter than any other place on the coast, the mean of which is 91 degrees, and it has more than double the annual rainfall of any other place on the coast, and over 15 per cent. more humidity.

Rainfall.—Taking the mean of the whole coast, we find that there are 49 showers per month, but they are almost entirely

sun showers, there being on many days 7 or 8, with an average of 39 thunder showers per year, and only 15 rainy days (nearly all rain) in a year, and about 48 per cent. of the days in the year are fair. The lowest temperature observed on the coast was 58 degrees in January, but at the Capital of Honduras, location 3,200 feet above the sea, it has fallen to 50 degrees, with a range of 40 degrees.

There were 35 wind squalls in a year, observed at the La Luz y Los Angeles mines, near Siuna, of which 51 per cent. occurred in October, January and February. The calm days in the year, at the same place, amount to 57 per cent., and the prevailing wind was 81 per cent. from the northwest quadrant.

The most excessive short rainfall was 13.25 inches in 24 hours at Greytown. An examination of Table XXVIII shows that the months of excessive rainfall are July, November, June, May, August, September and October, in the order named, which constitutes the rainy season, or "*invierno*." The great preponderance of excessive rainfalls at Greytown are well shown by the table. There were only 7 foggy days in the year at the mines and 13 nights with very heavy dews.

There were but 3 northers experienced during the year at the mines, and 1 hurricane on the Mosquito Coast on October 9-12, 1906, which did great damage to the banana and rubber plantations on or near the shore, and nearly destroyed the little town of Prinzapolca, which is situated at the mouth of that river and only elevated 2 or 3 feet above high water in the ocean.

October is recognized as a stormy and dangerous month on the north coast of Honduras and the Mosquito coast of Nicaragua, and the only three hurricanes of which I have any record occurred in that month. It was reported to me at Greytown that they had never experienced a hurricane there since the settlement of the place, and I lived there two years and did not experience any.

On the north coast of Honduras and the Mosquito coast, the mornings are generally calm up to 10 o'clock, when the sea breeze springs up and blows briskly in the afternoon. At night the land breeze blows and the rain generally occurs at night.

Evaporation.—Measurements were taken at the La Luz y

Los Angeles mines for 9 months, August to April, inclusive, resulting in 62.24 inches in that time, or at the rate of 83 inches per year. This gives 11 inches for run-off, which seems small. The evaporation may be too large. The determination of the exact evaporation in nature is a very difficult matter. When measured in a tin can it may be too large, owing to the heat of the sun on the outside of the can, if above ground. If the water is an inch or two below the top of the can the evaporation will be too small, as the wind cannot act on the surface. The effect of the velocity of the wind is very great. With a wind velocity of only 5 miles per hour the evaporation is 2.2 greater than in a calm, and with velocity 30 miles an hour, 6.3 greater. If the pan is filled flush full, some water will be blown out if the wind is strong. The method of measuring the evaporation in a pan floating in a lake gives much too small a result, as in the pan there can be no waves, while in the lake they may be very high, thus exposing 30 to 50 per cent. more surface to the wind, and when there are breakers or spray the exposure is 200 or 300 per cent. greater, and the effect is similar to that produced by rapidly decanting a liquid to cool it, or waving a wet garment in the wind. The only accurate way to arrive at evaporation is to measure the actual fall of a lake or large pond that has no outlet or inlet and no subaqueous springs.

The rainfall at Belize, British Honduras, for the years following, was:
In 1863, 54.12 inches; 1864, 77.87; 1865, 71.67; 1866, 67.40; 1868, 60.
Total in 6 years, 420 inches. Mean of 6 years, 70 inches. Average per month: 1863, 4.51; 1864, 6.49; 1865, 5.99; 1866, 5.62; 1867, 7.40; 1868, 5. Total in 6 years. 35.

The results of this table would be here given in full, but that the constant change of position and elevations while in the tablelands prevented a consecutive number of observations sufficient to establish a basis of temperature. I may add, however, that in the northers, which in the winter months often sweep with great fury over the country, the temperature is such as to require thick clothing throughout the day; and where fires are kept burning in the corridors they are surrounded with a huddling, shivering group. The mornings and nights are particularly cold. In conclusion, it is not too much to accord to the

interior of all Central America a climate not surpassed on the American Continent.

The following are extracts from a meteorological table kept during my first visit in Tegucigalpa (elevation 3,200 feet).

Table XVI.

Date.	Sunrise.	Noon.	Sunset.
1854.	Deg.	Deg.	Deg.
Oct. 18.....	64	75	70
19.....	65	76	72
20.....	64	76	72
21.....	66	76	72
22.....	64	75	73
23.....	65	75	73
24.....	66	75	72
25.....	66	76	73
26.....	67	75	72
27.....	66	76	72
28.....	66	76	72
29.....	65	75	72
30.....	65	76	73
31.....	65	76	72
Nov. 1.....	65	77	73
2.....	64	78	73
3.....	65	76	72
4.....	63	75	71
5.....	63	74	72
6.....	64	74	73
7.....	64	76	72
8.....	63	75	72
Means.....	64.77	75.59	72.18

Observations: The winds during the latter part of October were principally from the N.N.E. and E. Heavy afternoon and evening storms with thunder and lightning. Interludes of clear, bracing weather and light winds. Black, dense clouds descending below the peaks of the surrounding ranges during the rains, and light, feathery clouds in the intervals. The air cool and still from 5 until 9 a. m.

Maximum, 78 degrees. Minimum, 63 degrees. Range, 15 degrees.

Clear, dry norther. Rains and heavy clouds at night.

Table XVII.

The following figures are from observations taken during my first visit in Jutecalpa, 1,100 feet elevation.

Date.	Sunrise.	Noon.	Sunset.
1855.	Deg.	Deg.	Deg.
Jan. 3.....	62	70	69
4.....	61	72	70
5.....	62	73	68
6.....	60	72	69
7.....	61	75	69
8.....	62	72	70
9.....	63	73	70
10.....	62	73	69
11.....	63	74	69
12.....	63	73	69
13.....	61	73	68
14.....	61	73	69
Means.....	61.75	72.75	69.08

Observations: Infrequent but violent showers, with thunder and lightning.

Maximum, January, 75 degrees. Minimum, January, 60 degrees.

Winds N.E. and N. Much rain and low, dense clouds, with slight intervals of clear weather.

Table XVIII.

The following are from observations taken during my second visit to the Hacienda of Lepaguaré, 2,100 feet elevation.

Date.	Sunrise.	Noon.	Sunset.
1855.	Deg.	Deg.	Deg.
Jan. 16.....	58	72	70
17.....	59	72	70
18.....	58	72	70
19.....	58	72	69
20.....	58	73	70
21.....	59	73	69
22.....	58	72	69
23.....	59	73	71
24.....	58	74	70
25.....	58	74	72
26.....	59	74	72
Means.....	58.36	72.82	70.18

Observations: N. and N.E. winds, very light and fitful; dense fogs often overlaying the valleys and crowning the hilltops. Mornings cool and damp at noon, the wind stronger.

Maximum, 74; minimum, 58. Rain towards sunset and at night.

On Cerro de Ule, at an elevation of 5,000 feet, the thermometer showed at 7 p. m., on the 18th of March, 1855, 52 degrees Fahrenheit; this was during a strong, clear norther.

In relation to the norths (or northers) of the Caribbean coast of Central America, the following occurs in Captain Livingston's Translation of the Spanish Directory for the West Indies (*Derrotorio de las Antillas*):

"Upon the Mosquito shore, Honduras, and eastern coast of Yucatan, the general winds or breezes prevail in February, March, April, and May, but during the first two of these months they are occasionally interrupted by norths. In June, July, and August, the winds here are from the eastward and westward of south, with tornadoes and calms. In September, October, November, December, and January, they are from the north or southward of west, with frequent gales from W.S.W., N.N.W., and N."

"The first of the norths is regularly felt in the month of September, but in this month and the following one, October, the norths do not blow with such force. Sometimes* it happens that they do not appear, but in that case, the breeze is interrupted by heavy rains and tornadoes. In November the norths are established, blow with much strength, and continue a length of time during December, January and February. In these months, after they begin, they increase fast; and in four hours, or a little more, attain their utmost strength, with which they continue blowing for forty-eight hours; but afterward, though they do not cease for many days, they are moderate. In these months, the norths are obscure and north-westerly, and they come on so frequently that there is, in general, not more than four or six days between them. In March and April they are neither so frequent nor last so long, and are clearer, but yet they are more fierce for the first twenty-four hours, and have less north-westing. In the interval between November, in which, as we have said, the norths are established, the weather is beautiful, and the general breeze blows with great regularity by day, the land breeze as regularly by night."

*At this point I must state that I cannot agree, as my experience of nearly 6 years on that coast, is decidedly contrary, in regard to the force of the northers. The first weeks of October, 1898, while at Trujillo, I experienced a terrific norther which lasted without intermission for 16 days and did great damage all along the coast, and many Indians were drowned.

On October 1, 1904, a hurricane washed away the Indian town of Patuca at the mouth of the river of that name, and blew my steamer, "Maid of Patuca," out to sea, and then jumped round to the north and blew her back on the bar, where she went to pieces.

On October 9, 1906, hurricane struck the east coast of Nicaragua and destroyed many rubber and banana plantations and nearly wiped out the town of Prinzapolca. It overtook me on the Labu river and detained me in an Indian camp 6 days, and the river rose 22 feet in one night.

Health, Temperature and Rainfall of Honduras, C. A.

In regard to the health of this region, especial attention is called to the statements of Dr. Alex. Hunter, late Colonial Surgeon of British Honduras. These statements can be borne out by numerous others and by official reports of the United States and British Governments.

From an experience of over four years' residence on the Mosquito coast, in this state and the adjoining one of Nicaragua, I consider the reports as to their unhealthfulness to be gross exaggerations. I know from my own experience and my family's and that of some five hundred unacclimated white men from the United States, who composed my engineering and construction corps and general staff at headquarters on the Nicaragua Canal for over two (2) years, that any person, male, female, or child, of good health and general constitution, no matter how delicately raised, can come from the north and live on the Mosquito coast in perfect health, provided they take the least care of themselves, do not indulge to excess in intoxicating liquors, and do not build their houses and attempt to live in a swamp or on land subject to periodic overflow. If, however, they violate all hygienic, sanitary and moral laws, they will incur the penalty of sickness in Honduras as well as elsewhere. In fact, the highlands of Honduras will yet be recognized as a sanitarium for all persons afflicted with consumption, catarrh, or any bronchial affections, or who suffer from malarial or low coast fevers.

The death rate of Honduras in 1887 was 18.86 per 1,000, and this year (1899) for the City of Tegucigalpa is but 14.04. For the Department of Colon it was (1887) 24.49, and for Olancho 19.53, which compare very favorably with any cities in the States, and this with the total lack of all sanitary arrangements for which all Spanish-American cities are notorious.

Temperature.—The temperature of different places in Honduras varies greatly, the low coast lands being hot while the higher lands of the interior are colder in proportion to their elevation above the sea, until on some of the high mountain peaks frost is experienced in winter. Temperature falls 1 degree F. for ever 288 feet of elevation. The following thermometrical readings were taken by Mr. Thomas Young, at the mouth of the River Negro, 44 miles west of Patuca. They were taken daily at the middle of the day for one year. Although these were taken several years ago, the climate has not changed.

Table XX.

Month.	Mean Temp. Fahr.	Prevailing Winds.	Ruling Climate.
Jan.	62° to 66°	North and West.	Good, when there is a dry norther.
Feb.	66° to 70°		
Mar.	70° to 74°	Variable between light breezes and N.E.	Dry.
Apr.	74° to 76°	N.E. and breezes.	
May	78°	Strong breezes N.E.	
June	78° to 82°		
July	82°		Damp.
Aug.	84° to 86°	Light and variable airs and calms.	Dry.
Sept.	84° to 86°		
Oct.	78°	Breezes, some light northers.	Dry or damp, according to the wind.
Nov.	72° & less	North.	Damp, good weather when there is a dry norther.
Dec.	62° to 66°		Damp.

Mean, 74.17° to 75.75°. Maximum, 86°. Minimum, 62°. Range, 24°. Wind, N.E. quadrant 41%. Dry Weather 25%. Damp weather 33%.

Notes.—The climate here is equable, only varying during the year from 62 to 86 degrees Fahrenheit, so they never have excessive heat, as the greater part of the year is tempered by agreeable sea breezes and sometimes by the cooling dry northers.

The following observations were made in the vicinity of Carataska Lagoon, about 35 miles east of Patuca, by an illustrious Prussian Commission composed of Messrs. Müller, Jellechner and Hesse, between the 13th of June and the 2nd of August, 1844.

Table XXI.

Time of Day—	Mean Temp.
6 a. m.	78.5°
11 a. m.	83.1°
3 p. m.	83.4°
7 p. m.	82. °
	81.7

During this time the wind blew constantly from the E., E.N.E., or N.E., with the exception of three days in June from the S.W. and one day in July from the N.W. (Prevailing winds, June and July, N.E. quadrant.)

Mean minimum of temperature was 61° on July 2nd.

Mean maximum of temperature was 85° on July 4th.

At the mouth of the Patuca River, I caused thermometer readings to be taken from September 14th to 28th, 1898.

The highest observed was 90° at 1 p. m., September 25, and the lowest observed was 76° at 7 a. m., September 25. The mean of 14 observations between the 14th and 28th was 86.5°.

During this time the prevailing wind was from the E. and S.E., with light land breezes from the S.W. and salms in the forenoons, with showers at night.

The climate of the elevated regions is well illustrated by that of Tegucigalpa, and I therefore give herein a table of the temperature of that place, which was compiled by Dr. R. Fritzgartner, Ph. D., the Government Geologist, and kindly furnished me. I also give some notes of temperature of Comayagua and a few observations at Trujillo.

Temperature, Honduras, 1854.

Trujillo, 80 feet high:

July	82.75°
August	81.85°
October	80.27°
November	77.24°
December	74.08°

Maximum, 9 a. m., and minimum, 3 p. m.

(E. Purdot, for Smithsonian Institution.)

Samuel A. Bard, a writer in *Harper's Monthly*, gives the following observations of temperature taken in the vicinity of Jutecalpa.

"At Jutecalpa the mercury in the hottest weather of summer seldom rises above 95 degrees of Fahrenheit, and my own thermometrical tables kept during the fall and winter seasons, never fell below 52 degrees, and only once rose above 82 degrees, the best medium for health and exercise. My observations for temperature were made daily, three times a day, from September 27, 1854, to January 15, 1855. At 6 o'clock in the morning, observations made from December 16 to January 15 showed an extreme variation of only 9 degrees, 52 degrees to 61 degrees. Noon observations for the same days showed the same variation, 72 degrees to 80 degrees. The morning temperature at Lepaguaré was about 50 degrees, the noon 78 degrees, the evening about 74 degrees, for the winter season. It has never been known as hot at Jutecalpa, during July and August, as is frequent at New York and New Orleans. The temperature of Lepaguaré is probably finer and more equable than in any other part of Central America."

Rainfall.—Information on this point is very meager. It varies greatly in different localities. I cannot find that any record of rainfall has been kept in Spanish Honduras except in Comayagua by Mr. E. P. Mayes, an

English civil engineer, and also a report from San Pedro Sula. He reports as follows:

“Comayagua, minimum 42 inches per year.

“Comayagua, maximum 132 inches.

“Comayagua, from 7 p. m. to 11 a. m. on one night in August, 1899, there was a fall of 36 inches!”

San Pedro Sula, 1895, 230 inches.

It is stated by the Government Geologist, Dr. R. Fritzgartner, that the mean rainfall of the whole of Honduras is a little over 90 inches per year. Squires, however, says only 48 inches.

The rainy season, called winter (invierno), commences in May and lasts until November.

The dry season, called summer (verano) begins in November and lasts until May.

Maxima and Minima Thermometer

At Patuca, Honduras, 1898.

Kept under the direction of J. F. LeBaron, Chief Engineer,
American-Honduras Company.

Table XXIV.

(ORIGINAL)

1898 Date	No. Obs Them.	Hours of Obs. from		Thermometer		Prevailing Wind
		A. M. to P. M.		Max.	Min	
				deg.	deg.	
Sept. 12	4	7.30	8.20	86	80	Brisk
Sept. 13	3	8.00	4.45	80	76	Calm
Sept. 14	12	7.00	6.00	86	80	Calm to Str. SE
Sept. 15	11	7.00	6.00	87	77	Calm to Str. SE
Sept. 16	10	7.20	6.00	88	82	Light S. to Str. SE
Sept. 17	12	7.00	6.00	87	78	Calm to Strong SE.
Sept. 18	12	7.00	6.00	87	82	Calm to Light NE
Sept. 19	11	7.00	6.00	88	80	Calm to Str. NE
Sept. 20	11	7.15	5.00	88	76	Calm to Light NE
Sept. 21	12	7.00	6.00	87	78	Calm to Light E
Sept. 22	10	7.00	6.00	88	78	Calm to Light S
Sept. 23	8	12.00	6.00	86	80	S. Light
Sept. 24	11	7.00	5.30	90	78	Calm to E. Str.
Sept. 25	11	7.30	6.00	89	80	Calm to S. E. Str.
Sept. 26	11	7.00	6.00	86	77	Calm to Light SE.
Sept. 27	10	8.00	5.30	86	79	S. Light and Str.
Sept. 28	7	8.00	3.00	88	81	S. Light to S. E. brisk
Oct. 2	1	8.00		84		Calm
Oct. 4	1	7.00		80		E. Mod.

Total, 168

Mean 86.37 78.94 Calm to Str. SE

Max. 90 deg.

Min. 77 "

Range 14

Winds all light to calm in A. M.

“ 64 per cent. strong in P. M.

“ 73 per cent. from S. E. Quadrant.

• “ 33 per cent. from N. E.

Climate of Tegucigalpa, Hon. C. A.

Table Illustrating its Yearly Temperature.

Compiled by Dr. R. F. Fritzgartner, Ph. D., Government Geologist.

Table XXV.

Month	Average Temp.		Diff.	Extreme Temp.		Extreme Diff.	REMARKS
	Min.	Max		Low-est	High-est		
1888	F.	F.	F.	F.	F.	F.	
	deg.	deg.	deg.	deg.	deg.	deg.	
Ja .	60	76	16	54	79	25	Highest temp. 90 deg. F. in May.
Feb.	60	81	21	52	84	32	Lowest temp. 50 deg. F. in Dec.
Mar.	61	83	22	55	88	33	W. Long. 87 deg. 10 ft.
April	63	84	21	56	89	33	N. Lat. 14 deg. 10 ft.
May	67	84	17	63	90	27	Altitude 3200 ft. above sea level.
June	67	82	15	65	86	21	Ex. Variations 40 deg. in the year.
July	67	81	14	64	84	20	Rainfall in May, 1896, Elev. 3420 ft.
Aug.	66	81	15	62	84	22	Instituto Nacional
Sept.	65	82	17	61	84	23	May 27—1.00.
Oct.	65	79	14	61	83	22	" 28—0.17.
Nov.	65	78	13	61	82	21	" 29—0.74.
Dec.	59	75	16	50	81	31	" 30—0.48.

Excessive Precipitation in Eastern Nicaragua and the Honduras.

Compiled by J. FRANCIS LEBARON, C. E.

Table XXVIII.

(ORIGINAL)

LOCATION	JAN. In. Day	FEB. In. Day	MAR. In. Day	APRIL In. Day	MAY In. Day	JUNE In. Day	JULY In. Day	AUG. In. Day	SEPT. In. Day	OCT. In. Day	NOV. In. Day	DEC. In. Day	Month unknown In. Day	Years of Obs.
Spanish Hsa.														
Coco River							12 h							5½
British Hsa.							1.08 30						6.00	
Belize		20 m						7.40						
Eastern Nic.		0.40 16					2.80 25			4.00 10				
La Luz Mine														
Bluefields														
San Juan Valley														
Greytown	4.35 20			5.75	28 5.08	7.20	57.38 17		3.25	20 4.60	20 4.80 15			4
	3.15 4			4.95	24.31	13.83	54.20 15.70	4 4 05	4 4 05	7 4 00	9 4 10 5			7
	4.16 5			4.57	3 (9)	64.31	24.23 11 5.78 29	15 5.60	11 5.78	29 5.12 20	7.65 27			
				5.10	54.51	22 5.02	134.40 4 6.10	20 8.02 31	3.24	9 8.95 5				
				5.80	64.00	34.66	143.10 5 3.52	22 4.69 20	4.90	10				
				4.10	75.00	19 5.30 23	3.68 10 3.15	25 4.97 20	4.35	11				
				4.20	83.07 18	3.29	11 6.29 14		7.40	2				
				5.60	65.25	23 8.17	18 3.68 14 3.41 28		8.76	3				
				5.08 10		3.05 9	3.08 10		5.70	4				
						4.89 11	3.63 13		4.83	8				
						3.20 22	3.95 27		3.32 26					
						- 3.26 30			3.03 28					
Silico Lake														
Ochoa				7.12		3.06 13	3.31 13 3.23	25 3.20 14						
Camp No. 4						3.24 8	5.25							
						4.51 27	6.70 6							
Camp Carazo	3.00 22				2.90 21	4.60 27 3.07	19 3.27 1							
Sabalos					3.05 11									
Castillo														
Machuca														
San Carlos River														
San Francisco River	3.74 2			3.63 5		3.01 24								
Rio Sarapiquí	4.61 2													
Descado River	4.37 4					2.83 20								
	3.04 27													

N. B.—Where not otherwise noted the duration of the rainfall is 24 hours.

Comparison of Climates.

Table XXIX.

Comparison of Climates.

(ORIGINAL)

LOCATION	Showers Per Month	TEMPERATURE			Annual Rainfall	Mean Humidity	Thunder Showers Per Year	Days of Rain	WIND QUADRANT				Fair Days	REMARKS
		Max.	Min.	Range					N. E.	S. E.	N. W.	S. W.		
Greytown	No.	deg. 98	deg. 66	deg. 32	In. 260	85.4		per ct.	25	8			per ct.	Temp. and Humidity 2 yrs. obs. Rain 7 yrs.
Bluefields	36	90	59	31	124		26	37			81		53	Temp. for Aug. Rain 1 yr. interpolated
Prinzapolca Valley					94									Rain days of 12 yr. obs
Coco Valley	62	83	71		75		53	37	53	26	34		67	Rainfall 18 yrs.
Belize		92	58	34	78	74							75	Max vel. of Wind 25 m per hour. 1 yr. obs.
Tegucigolpa		90	50	40										18½ months.
L. L. y L. A. Mines		90	59	31	89									January obs. only.
Olancho		75	58	17				67					27	May and June obs. only
Trujillo		89	71	18				33	41				25	1 year obs.
Rio Negro		86	62	24					33	73				Sept. obs. only
Patuca		90	76	14										
Mean of Whole Coast Region	49	91.2	60.8	30.4	120	82.2	39	35.7	39.7	17.	57.5		48.3	Omitting Tegucigolpa, Olancho, Trujillo, Patuca and Coco.

In conclusion I desire to express my thanks to Mr. Thomas W. Waters and Dr. Thornton, of Bluefields, Nic., and to Dr. R. Fritzgartner, Ph. D., Government Geologist of Honduras, for copies of records made and furnished.

**THE FAILURE OF EMETINE HYDROCHLORID, BUT THE
APPARENT SUCCESS OF SALVARSAN, IN A
CASE OF BALANTIDIOSIS.**

By

MAJOR B. H. DUTCHER,
Medical Corps, U. S. Army,
San Juan, Porto Rico.

The occurrence of a case of balantidial infection in a soldier of the Porto Rican Regiment of Infantry has afforded an excellent opportunity to test the efficacy of these drugs.

The habitat of *Balantidium* within the tissues of the colon, and its fairly close biologic relationship to the entamœbæ, were sufficient to lead to the hope that emetine might have the same effect upon the former that it seems to have upon the latter.

On most occasions up to April 7, 1914, when treatment was begun, a dose of magnesium sulphate was all that was necessary to secure the parasite.

My laboratory notes show that balantidia were found nineteen times between December 27, 1913, and April 6, 1914.

On April 7, 1914, the following treatment was instituted:

Magnesium sulphate, saturated solution, tablespoonful every three waking hours. The salts were continued with an occasional intermission of a day until April 30. They were given with the idea of quickly eliminating from the intestines as many ciliates as possible, to avoid the possibility of reinfections.

April 7, emetine hydrochlorid $\frac{1}{3}$ grain, hypodermically three times.

April 8, same.

April 9, same.

April 10, $\frac{2}{3}$ grain, or double the dose, three times.

April 11, same.

April 12, same.

April 13, same.

April 14, same.

April 15, same.

April 16, stopped.

During this time there was felt no apparent discomfort. He had one or two very dark, formed stools per day.

On April 18, emetine hydrochlorid, hypodermically, 1 grain, three times.

April 19, 1 grain, only once.

April 20, 1 grain, three times.

April 21, same.

April 22, stopped.

On April 21, the patient complained of considerable nausea and weakness, with dysenteric symptoms, and for this reason the drug was discontinued. His pulse had also begun to show signs of weakness.

During the emetine course balantidia were found in the stools continuously from April 10 to April 22. In some instances they were numerous, in others several specimens carefully searched revealed but one or two. Sometimes they were very active, again perfectly quiet. On April 22, they were particularly numerous and active.

On April 23 and until the 28th the most careful search failed to reveal one, and it was hoped that they had perhaps disappeared for good. But on April 29 they appeared again, beautifully clear and very active, and continued so on April 30 and May 1.

Emetine apparently having failed, on May 5, 0.6 gms. salvarsan was administered intravenously. Since that date up to the present writing, July 10, the stools have been examined carefully on twenty days without finding balantidia on a single occasion.

The patient states that he has felt in much better health since the salvarsan, but it is quite possible that this may be psychical or due to a tonic effect of the arsenic.

As far as could be observed he was in very good general health all the time that he carried the infection.

NEWS AND COMMENT

Dr. Claude C. Pierce, U. S. P. H. S., has been named sanitary inspector of the Panama-Pacific Exposition.

The representatives of the Rockefeller Foundation who have gone to Guatemala to study hookworm arrived in Guatemala City on March 2.

The New York Department of Health has passed an ordinance prohibiting the taking of dogs into stores where meat, groceries or other foods are displayed.

The bill to provide \$25,000 for the use of the State health officers of Texas to prevent the entrance of plague into Texas was defeated in the State Senate.

The Health Department of New York City, through Dr. S. S. Goldwater, health commissioner, has returned \$170,000 to the treasury as the unexpended balance for the year.

The anti-vaccinationists are busy in New England trying to get Mount Holyoke and Wellesley Colleges boycotted because they require Freshmen to be vaccinated upon entrance.

A thoroughly equipped model hospital is being run at the Panama-Pacific Exposition as a working exhibit of the U. S. Public Health Service. Surgeon Reel M. Woodward is in charge.

The bill authorizing the establishment of a leper home under the direction of the U. S. Public Health Service has passed the House of Representatives and gone before the Senate.

Typhus in claiming a large number of victims both in Servia and Austria many of whom are doctors, nurses and

priests. In February, 346 new cases were reported in Vienna in one week.

Dr. Edward C. Seaton died in London recently. Dr. Seaton was lecturer on public health at St. Thomas' Hospital and was prominent in many matters pertaining to public health in London.

The National Committee on Mental Hygiene has recently received two large donations, one of \$44,500 from Mrs. Elizabeth Milbank Anderson and one of \$40,000 from Mrs. William K. Vanderbilt.

The Louis Livingston Seaman medal for progress and achievement in the promotion of hygiene and the mitigation of occupational diseases, has been awarded to Surgeon-General William C. Gorgas.

A division of industrial hygiene is to be established by the New York City Department of Health. It will be under the general direction of the director of the Bureau of Infectious Diseases.

After an inspection made by the State Board of Health, the Indiana Legislature passed a bill to abolish the free lunch counters in saloons, as the majority were found in a very unsanitary condition.

Dr. Victor G. Heiser, Director of Health and Chief Quarantine Officer of the Philippine Islands, has been relieved of duty there and given a year's leave of absence. Dr. Heiser was directed to proceed to San Francisco.

Dr. S. S. Chuan, a specialist in sanitation and preventive medicine, has been appointed Surgeon-General of the Chinese Army and president of the Army Medical School. Dr. Chuan graduated from Harvard Medical School in 1899.

A laboratory for the analysis of water and food has been established at the Marine Hospital in Chicago by the United States Public Health Service, with Assistant-Surgeon Charles L. Williams and Sanitary Engineer H. P. Letton in charge.

Dr. C. C. Bass, of New Orleans, gave a lecture on alveolo-dental pyorrhea before the Fulton County Medical Society and the dental profession of Atlanta on March 18, and lectured to the medical and dental profession of Savannah on the same subject March 19.

In the ninth Weir Mitchell lecture delivered at the College of Physicians, Philadelphia, Dr. Charles Wardell Stiles advocated a nation-wide campaign and expressed the belief that only by such a campaign could communicable diseases be stamped out.

Three hundred bulletin boards are to be erected in the crowded districts of Philadelphia, upon which health information will be posted. The health talks will be printed in many different languages, according to the nationality of the people of the different neighborhoods.

Announcement has been received from the Rockefeller Foundation of the change of address of the International Health Commission from Washington, D. C., to 61 Broadway, New York City. On the first of January the International Health Commission succeeded the Rockefeller Sanitary Commission.

A correspondence course for health officers has been arranged by the University of Wisconsin. It is intended especially for those health officers who are in need of a more thorough training but are unable to leave their work for a sufficient length of time to take a regular university course.

The Committee on Public Health of the New York Academy of Medicine is anxious that the New York Quarantine Station be placed under Federal instead of State control. They have completed a special study on the subject and have sent a letter to

the Governor giving several very conclusive reasons for this change.

A course of lectures will be given at the Rush Medical College from April 3 to May 8 on "so-called tropical surgery and borderline diseases." The lectures will be given by Dr. John D. McDill of Milwaukee, formerly professor of surgery of the University of the Philippines. The lectures will be free to the medical profession.

Dr. Allen J. McLaughlin, State Commissioner of Health of Massachusetts, was asked by the American Red Cross Society and the Rockefeller Foundation to take charge of a campaign against cholera and typhus in Servia. Dr. McLaughlin declined, however, stating that his duties as health commissioner would not permit him to leave.

Dr. S. Goldwater, Commissioner of Health of New York City, retired on April 1, when his leave of absence as superintendent of Mt. Sinai Hospital expired. During the short time Dr. Goldwater has been commissioner of health he has brought about many much-needed reforms and his inability to continue in this office is a serious loss to that city.

The Southern Sociological Congress will hold its fourth annual meeting in Houston, Texas, May 11, "Conservation of Health" will be the general theme and will be divided under the following heads: "The Prevention of Communicable Diseases," "Moral Health," "The Health of Children," "Mental Health," "Health and Race Relations," and "The Church as the Conservator of Social Health."

The Rush lecture was delivered this year on April 7 in Philadelphia by Dr. C. C. Bass, of the Tulane School of Medicine, New Orleans. Dr. Bass's subject was "Recent Observations of the Life of Malarial Plasmodia." While in the East, Dr. Bass also delivered lectures before the American Philosophical Society in Philadelphia and at the Medical Department of the University of Maryland.

The Rockefeller Foundation has laid plans for extensive educational work in China, which will include the improvement of the two medical schools there and the conditions found in the hospitals. These schools have been doing excellent work for sometime, considering the limited facilities at their disposal, and the assistance and co-operation of the Rockefeller Foundation will assure their success and continued service.

It is reported that a petition has been sent Surgeon-General Rupert Blue, U. S. P. H. S., by President Lowell of Harvard University, President McLaurin of the Boston Institute of Technology, President T. W. Sedgwick of the American Public Health Association and State Health Commissioner Allen J. McLoughlin, who are anxious that Surgeon-General Blue reconsider his refusal to grant the desired leave of absence to Surgeon Richard H. Creel, allowing him to become head of the Boston Board of Health.

The unit from Harvard which will relieve that from the Western Reserve Medical School, left on March 17 for the American Ambulance Hospital, Paris. Dr. Harvey Cushing is head surgeon and Dr. Robert B. Greenough is executive officer, with the following as members: Drs. Richard P. Strong, Walter M. Boothby, Robert B. Osgaad, Beth Vincent, Frederick A. Collier, Elliott C. Cutler, Philip D. Wilson, Marius N. Smith-Peterson, Lyman G. Barton, Jr., Orville F. Rogers, Jr., and George Bennett.

The seventh Pan-American Congress will meet in San Francisco, June 17-21, inclusive. It assembles pursuant to invitation of the President of the United States issued in accordance with an act of Congress approved March 3, 1915.

The countries and colonies embraced in the Congress are the Argentine Republic, Bolivia, Brazil, Canada, Colombia, Cuba, Chile, Costa Rica, El Salvador, Ecuador, Guatemala, Honduras, Haiti, Hawaii, Mexico, Martinique, Nicaragua, Panama, Paraguay, Peru, Santo Domingo, United States, Uruguay, Venezuela, British Guiana, Dutch Guiana, French Guiana, Jamaica, Barbadoes, St. Thomas and St. Vincent. The organization of the Congress is perfected in these countries and the majority of them

have signified their intention to be represented by duly accredited delegates.

The Congress will meet in seven sections, viz: (1) Medicine; (2) Surgery; (3) Obstetrics and Gynecology; (4) Anatomy, Physiology, Pathology and Bacteriology; (5) Tropical Medicine and General Sanitation; (6) Laryngology, Rhinology and Otology; (7) Medical Literature.

All members of the organized medical profession of the constituent countries are eligible and are invited to become members. The membership fee is \$5.00 and entitles the holder to a complete set of the transactions. Advance registrations are solicited and should be sent with membership fee to the treasurer, Dr. Henry P. Newman, Timken Bupilding, San Diego, California.

The first Pan-American Medical Congress was held in the United States in 1893. Five intervening Congresses have been held in Latin American countries. It now devolves upon the medical profession of the United States to make this, the seventh, the most successful in the series.

Public Health Activity.

COLORADO—Second Annual Report of the Social Welfare Department of the City and County of Denver, Colorado, December 31, 114. The first thought that enters the minds of the great majority of persons, upon learning that they are suffering from tuberculosis, is Denver. Once in Denver, they feel that there is some chance for their recovery. Many of these unfortunates, some with large families, are in no financial condition to take the trip, but every available penny is scraped together for, as they think, this last chance. And the outcome is that into poor Denver pour penniless families from all parts of the country. These people must live, so a great part, if not all, of the burden of their support, falls upon the charitable organizations of the city. Sufferers from the "Great White Plague" will learn some day that as good treatment can be had at home. Then money will be saved and the burden will be lifted from the shoulders of those who have carried it too long.

NORTH CAROLINA.—The Health Bulletin, March, 1915. The *Sentinel* (Caswell County, N. C.) stated recently: "The Cas-

well County Board of Health was in session Monday for about five minutes." Also: "Heretofore two reputable physicians have been members, but in the interest of economy no appointments were made for this year. There was no business before the Board Monday, except organization." Apparently, the sense of economy of the Board of Health of Caswell County is a bit distorted, also their idea of the meaning and duty of a Board of Health. As the Bulletin states, the death rate from preventable diseases in that county is high, yet there was "no business except organization." "In the interest of economy" seems to supersede in the interest of humanity here, as unfortunately it does in many other places.

PHILIPPINE ISLANDS.—Quarterly Report of Bureau of Health, Second Quarter, 1914. An effort was made during the quarter to collect all lepers from the provinces and transfer them to Culion. These were 420 transferred against 513 for the same period last year, which shows a considerable decrease. Dr. E. Mercado of San Lazaro Hospital and Drs. Clements and Martin of the Culion Colony, are making encouraging progress in the treatment of leprosy with chaulmoogra-oil mixture.

PORTO RICO.—Report of the Director of Sanitation, 1914. Notwithstanding the economic depression prevailing, the death rate for the last year reported, 1913, is the lowest in Porto Rico for twenty years. Owing to the financial crisis, strikes in the tobacco factories and the closing of some of the sugar plantations, it was feared that the almost certain poverty and privation might cause an increase in morbidity and mortality. This, however, did not seem to follow. The statistical department of Porto Rico is far more accurate than that of the United States and the 18.6 per cent., therefore, compares very favorably with the States of the Union.

TEXAS.—Bulletin of the Texas State Board of Health, November-December, 1914. A summary giving the percentage of deaths at different ages show that the greatest number of deaths occur under one year—19.38 per cent. of all deaths. The lowest per cent. is .86 between the years 4 and 5. Next to the highest is 5.85 per cent occurring between 65 and 70. Adding the percentages of deaths between the years 1 and 25, the total, 18.95 per cent. is still less than that occurring in the first year of life.

CURRENT LITERATURE

PLASMODIUM TENUE (STEPHENS) UNCONFIRMED.—(*Journal of Tropical Medicine and Hygiene*, December 1, 1914.) Drs. Andrew Balfour and C. M. Wenyon report on their investigations concerning a variety of malarial parasite claimed by Dr. J. W. W. Stephens to be a new species and which he named *Plasmodium tenue*. Balfour and Wenyon carefully studied the subject and came to the conclusion that Stephens was not dealing with a new species of malarial parasite, but figured and described an amœboid form of benign tertian plasmodium, which the authors had previously described in 1908. The term *Plasmodium tenue*, therefore, does not deserve a place in malarial nosology.
A. McShane.

BLACKWATER FEVER IN FORMOSA.—(J. Hatori, *Annals of Tropical Medicine and Parasitology*, Series T. M., Vol. VIII, No. 4.) The article consists of a series of fifteen tables of statistics compiled from personal experience and from reports of various provincial sanitary officers. A map of the island of Formosa is appended showing the relative prevalence of blackwater fever in the various districts. The disease is distributed throughout the island and varying, though, locally and annually in virulence. Newcomers and laborers have been more usually the individuals suffering both from malaria of all types and including blackwater fever following infection with malignant tertian. The Japanese and Chinese are apparently more subject, while among the native Formosans blackwater fever is rare. Adults, especially men, are more usually attacked, throughout the whole year; the period of least prevalence being during March, August and September. One physician observed malarial parasites in 85 per cent. of the cases just previous to the onset of the attack. The author found parasites in 96.3 per cent. of 26 cases examined. They were very much less often found after the attack had subsided. Length of residence, hygienic surroundings, poor

nourishment, indeterminate and irregular dosage with quinin are, according to the writer, among the predisposing cases. With regard to the latter drug, the author finds that the majority of cases develop after quinin medication and that this interval may vary from half an hour to several days, though the onset may develop after the first dose or doses. Table XI gives these observations: Thymol hemoglobinuria in ankylostomiasis cases was observed in several cases and required to be differentiated. Recurrence was comparatively infrequent, though six occurrences in one case, the last being fatal, were observed. The mortality ranges from 10 to 25 per cent. The anti-mosquito measures have completely eradicated the disease among the garrisons, and it is hoped that the extension of these measures throughout the island will result in a complete eradication of the disease.

L. C. Scott.

SPLENOMEGALY: BEING A REPORT ON A HUNDRED AND FOUR CASES MET WITH IN SOUTH CHINA.—(Three charts and eight tables.) G. Duncan White, *Ibid.*) The article is the result of observations on cases treated at the Swatow Hospital of South China. The various diseases recorded in text-books in which enlarged spleen is a prevailing symptom are first considered, followed by an analysis of the cases and attempts to fit the symptoms to some one of them. Briefly, the familial prevalence was established in 40 per cent. of the Swatow cases, and in 28 per cent. the disease had been noted for ten or more years. With regard to fever, 88 per cent. had at some period been affected. Edema or ascites occurred in 62 per cent., hemorrhage in 61 per cent., diarrhea in 50 per cent., enlarged spleen, prevalent of course in all, varied in size from 13x11 centimeters up to 53x23 centimeters, the former being found in a man who had suffered for 20 years. Hepatic enlargement occurred in about half the cases. The period of maximum enlargement of both spleen and liver seems to be during the fourth to sixth year of the disease. Table I shows the hemoglobin content to vary in 75 per cent. of the cases between 50-70 per cent. Besides this, other blood changes, such as the presence of erythroblasts, poikilocytes, leucopenia, etc., were found. The author concludes that it is impossible to definitely say what malarial cachexia, histoplas-

mosis, splenic anemia, or some unknown etiological factor is responsible for the enlargements and that the ratio of the red to the white cells, which was found useful in differentiating malarial cachexia from kala-azar in India, does not apply to patients in Swatow.

L. C. S.

NOTES ON THE DIAGNOSIS OF ASIATIC CHOLERA AT AUTOPSY. (*Philippine Journal of Science*, Vol. IX, No. 4, Sec. B, Tropical Medicine, August, 1914.) B. C. Crowell reports the common findings at autopsy of 92 cases and gives important points in recognizing the condition grossly before bacteriological proof can be obtained. A résumé contains the salient features for a diagnosis grossly.

P. L. Querens.

THE EMETINE AND OTHER TREATMENT OF AMÆBIC DYSENTERY AND HEPATITIS INCLUDING LIVER ABSCESS.—(Leonard Rogers, *Indian Medical Gazette*, Vol. XLIX, No. 3.) In demonstrating the superior efficiency of the emetine salt, the author used common paramœcia, owing to the impracticability of using amœba and concludes that it is more efficient than the cephaline salt, and mixtures of the two give intermediate results. Clinically the therapeutic effect of the latter is easily proven inferior.

The equivalent toxicity of the dosage for man amounts to about 15 grains and the extreme intravenous dosage would be 2 grains well diluted. In dysentery complicating pregnancy, the author uses $\frac{1}{2}$ grain doses twice daily at first. In acute hepatitis, he advises the use of emetine for a longer period of time than for dysentery, with gradually increasing intervals between doses and a frequent leucocytic count as a control. If the total white count gradually diminishes, persistent treatment is advised, and if no diminution results, the usual surgical methods are best resorted to. Aspiration of abscesses is advised whenever possible, and if the pus is bacteria-free, the injections of the salt until pus ceases to collect.

P. L. Q.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

Report of the Director of Sanitation of Porto Rico, 1914.

Thirteenth Annual Report of the Institute for Medical Research, Kuala Lumpur, Federated Malay States, 1913.

Transactions of the Society of Tropical Medicine and Hygiene, February, 1915, Vol. VIII, No. 4.

BOOKS.

PUBLIC HEALTH LABORATORY WORK. By Henry R. Kenwood. Sixth edition: Hoeber, New York, 1914.

The new edition of this excellent laboratory guide will doubtless be heartily welcomed by all workers in public health and hygiene. The clear, concise diction, the discriminating choice of approved methods by the experienced author, and the arrangement of the material, are qualifications which recommend this volume most highly.

The writer has collected his methods under six headings, dealing with the examination and analysis of water, sewage and sewage effluent, of soil, air, food and disinfectants. Each subject is treated appropriately under numerous subheadings. These comprise the more common applied and approved methods of chemical analysis, easy of comprehension, simple, readily carried out, and producing accurate results.

While the whole is adapted to British sanitary requirements and may deviate in some respects from the rules laid down by the A. P. H. A. or departmental methods, the underlying principles are the same and due regard is accorded American procedures.

The plates of objects found in impure water placed before the introductory chapter are somewhat crude in execution, and one could conceive that they belonged either within the chapter dealing with water examination or at the end of the book. Moreover, it would seem that for the sake of completeness, chapters on such subjects as immunity, ventilation and heating might have been introduced. The two latter, though subjects usually decided on by the architects, can doubtless be efficiently controlled by a health officer familiar with the physical procedures of examination.

These are, however, but minor objections and detract nothing from the true value of the material as it stands. As a handy and reliable reference, the book should be found in every public health laboratory.

L. C. Scott.

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ROGERS, LEONARD. The Emetine and Other Treatment of Amœbic Dysentery and Hepatitis including Liver Abscess. Reprinted from the *Indian Medical Gazette*, Vol. XLIX, No. 3, March, 1914.

ROGERS, LEONARD. Further Experience of the Specific Curative Action in Amœbic Disease of Hypodermic Injections of Soluble Salts of Emetine. Reprinted from the *British Medical Journal*, August 24, 1912.

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EDITORIAL

The Panama-Pacific Exposition.—Many circumstances have arisen to alter the original aspect of the San Francisco Exposition this year. The significance of the Panama Canal itself, great as it must be in the history of twentieth century events, has paled in the presence of a calamitous war, the results of which have already made the cataclysms of centuries seem like mere accidents.

The celebration, then, of the opening of the Panama Canal has lost its importance, and the great exposition of the Pacific coast has taken on a virtue of its own. The United States and some foreign governments have given enough of display to make the Exposition both dignified and broad in its scope, and Americans at least have already shown the inclination to give it the patronage it has deserved, for the artistic, educational and economic values it carries.

In after years the Exposition will stand as having satisfied its purpose of emphasizing the achievement of the Panama Canal, and when a day of peace arrives, a fitting ceremony may obtain which will properly celebrate the opening of the Canal and the joining of the two great oceans.

It is particularly fitting that the City of San Francisco, for the sake of its exposition period, should have been selected for the congress of scientific men represented by the medical profession in such associations as the American Medical Association, the Pan-American Medical Congress, the American Society of Tropical Medicine, as well as a number of other medical bodies. The gathering of medical men celebrates in a most appropriate manner the contribution of medical service to the results achieved in the Panama Canal. Worldly credit has already come to General Gorgas, of the Army, and to his associate, Assistant Surgeon-General H. R. Carter, of the Public Health Service, but their work in Cuba and in Panama is just a part of the achievement in tropical and preventive medicine, which has cost the profession the sacrifice of such men as Reed, Lazear, Ricketts, Carroll, McClintock, Brinckerhoff—some among those who have taken chances for humanity's sake in the pioneer work with disease.

The American Medical Association will hold a memorial session during the meeting, and each of the bodies gathering in San Francisco will be impressed with the messages the unwritten glory of some of these men have left behind, for just as the history of the world has been so largely written in the blood of nations, so the history of medicine has been made through the sacrifice of the physicians who have dared, in spite of danger, to test the hoped for truth.

No one of the bodies meeting in San Francisco has a more

important relation to the Exposition than the American Society of Tropical Medicine, and its session should be well attended, particularly as the Exposition has set aside June 16 as "American Society of Tropical Medicine Day."

Isadore Dyer.

ORIGINAL ARTICLES

CRAIGIASIS.

By

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Introduction.

In February of 1914, while studying intestinal infections in Honduras, it was noticed that certain of the cases presenting symptoms of chronic diarrhœa, or mild dysentery, had in the feces an actively motile flagellate, which did not correspond to the descriptions of *cercomonas* or *trichomonas* and which repeated observation, under an immersion lens, at the time when motion was becoming sluggish and ceasing, demonstrated to have but one flagellum. It was accordingly considered as a *cercomonas* of a different species than those reported.

As *cercomonas* is considered a harmless parasite, no particular attention was given it, other than to record its presence.

In June, 1914, a great many cases had been examined, in the course of the investigations concerning the prevalence of intestinal parasites on the coast of Honduras and this flagellate was observed in over 30 cases. These cases had all presented symptoms of chronic diarrhœa, or mild dysentery, and had all presented amœbæ which had been invariably recorded as "amœbæ resembling *entamœba histolytica*," while the cases of dysentery without the flagellates (recorded as *cercomonas*) were recorded as *E. histolytica*. The additional fact that no cases of the flagellates were found without these symptoms, and that the peculiar amœbæ were always found when the "*cercomonas*" occurred, led to the conclusion that the parasite must be the same, or a similar species, to that described by Craig, as *Paramœba hominis*, and afterward renamed by Calkins: *Craigia hominis*.

From this time on, the cases were studied very thoroughly and a careful record kept. It may be mentioned that *Tricho-*

monas intestinalis, although not common in this locality, is occasionally imported. The writer has a case of infection at present under treatment, and is certain, whether his description be confirmed in all details, or not, that he can at any and all stages, distinguish between this species and the parasite about to be described. There is a casual resemblance under low power.

The following report is based only upon those cases which were seen after this time, with the exception of cases 1 and 3; all of them reported after the identity of the swarmers with the amœba was recognized. These two cases contained in the record the statement, "probably *E. histolytica*, no typical form present."

About 30 other cases have been studied; 29 of the forms described below as *Craigia migrans*, and 1 of *Craigia hominis*; but the records were made before the nature of the parasite was clearly understood, and they were, therefore, excluded from the report. In none of these cases was *E. histolytica* to be observed.

Cases 2, 4, and 13 to 26, inclusive, were all seen after the differential points were well understood, and in all of them many slides were examined from as many different specimens as could be obtained. All the amœbæ were scrutinized, and in none of these cases were there any amœbæ which did not have the nuclear structure of *Craigia*, rather than that of *E. histolytica*, and in which the other differential points did not agree with that of the nuclear structure. The writer, therefore, feels that *E. histolytica* may be excluded as a cause of any of the symptoms described.

As the writer has reported, in another communication, only a very small percentage of the natives are free from at least one or more of the common intestinal parasites, and in an untreated locality, over fifty per cent. suffer either latent or active malaria. To simplify the reports, and to avoid too lengthy a report, the full details of the examination,—which in all cases included blood, feces, urine, and a careful history and physical examination,—will not be given. Such symptoms as are easily accounted for by other conditions, and which persisted after the removal of the parasites, are mentioned in the

case reports. Therefore, if no mention is made of such symptoms as enlarged spleen, cough, etc., it should be understood that they either did not occur, or, if they did occur, there were other causes sufficient to account for them, and that the disappearance of the *Craigia* was not accompanied by the disappearance of these symptoms.

Most grateful acknowledgment is made of the kindness of Capt. Charles F. Craig, who supplied literature, had the patience to study the poorly stained specimens sent to him; read over the preliminary report, and rendered every assistance in his power.

The author also wishes to acknowledge his indebtedness to Miss Mildred Gauche, assistant in biology in the Department of Tropical Medicine of Tulane University, for the reproduction of his original drawings from fresh specimens, assisted by the observation of iron-hematoxylon stains.

Definition.

Craigiasis is a diseased condition of the body, produced by infection with protozoa belonging to the genus *Craigia*, Craig, 1908¹, emend Calkins, 1913², ³.

Etiology.

Craig's cases were all residents of the Philippine Islands, or recent arrivals from there. A case has been reported from Memphis, Tenn. The following cases were encountered in Honduras, and the writer had a case of a German resident of Fayette County, Texas, to which the description of case 23 could be applied without alteration, and in which a supposed cercomonas was encountered. The case resisted all approved means of treatment of hyperacidity and gastric ulcer, and was probably a case of Craigiasis. It is probable that this genus has a wide distribution.

The cases here have been grouped from among those furnished with drinking water from certain streams, and this grouping has been so marked that there is but little doubt that the chief source of infection is from polluted water. It is possible *a priori* that introduction into the mouth of the parasites after direct or indirect contact with infected cases might cause

infection, and the occurrence of several cases in the same family, in settlements where all drink the same water, occurs with sufficient frequency to suggest that this method is not unusual.

There have been 56 cases observed in this locality, of which 26 are reported below. The other 30 are not reported, on account of imperfect records, as stated above. Of these 56 cases, 5 were infections with a parasite which agrees in every respect with *C. hominis*, as described by Craig. The other 51 were infections with a slightly different parasite, the standing of which must be determined by the protozoologists, but which for the purpose of description and identification will be referred to in this report as *Craigia migrans* (N. Sp.).

Morphology of *Craigia hominis*.

This description, with some abbreviations, is taken entirely from Craig's paper⁴.

Life Cycle: In the amœbic stage, the organism reproduces by simple division as a typical amœba for several generations, as long as conditions are favorable. It then encysts, and within the cyst are developed numerous small swimmers which, on escaping, develop a single flagellum; reproduce by longitudinal division for several generations, after which the flagellum disappears, and the amœbic stage of development is again entered.

Beginning as a spherical body, 3 to 6 microns in diameter, with a finely granular cytoplasm and a poorly defined refractive nucleus, the young forms develop a single, very delicate flagellum, and move forward in a jerky manner. When fully developed, the flagellate measures 10 to 20 microns in diameter; is spherical, slightly elongated where the flagellum arises, and consists of a finely granular cytoplasm in which lies a spherical nucleus having a well defined nuclear membrane composed of refractile granules. An accessory nuclear body may sometimes be distinguished as a refractive granule or rod. The protoplasm of the flagellate stains very intensely. The nucleus is of the *Vahlkampfia* type; the nuclear membrane somewhat thin, and composed of minute granules. The flagellum stains poorly, or not at all. Division is by a primitive form of mitosis. The nucleus and accessory body divide; then the flagellum, and,

finally, the two individuals separate. After dividing for several generations, the swimmers lose the flagellum; develop amœbic motion, and enter the amœbic stage.

The amœbæ vary from 10 to 25 microns in size, average 18 microns. At rest they are round or oval; when moving, very irregular, as several pseudopodia may be projected at the same time. When fully developed motility is very active, and progressive movement marked, and there is a sharp distinction between ectoplasm and endoplasm,—the latter being very refractive, the former thin and veil-like. In motionless organisms and in the small organisms, in which motility is sluggish, there is no distinction between ectoplasm and endoplasm. This is also true of stained specimens. Bacteria, crystals, and red cells may be observed within the endoplasm. The nucleus can nearly always be distinguished, appearing as a refractive, spherical body, surrounded by a thick and more refractive nuclear membrane of granular consistence, or appearing like refractile rods arranged end to end around the periphery. The nucleus stains intensely, and the morphology is similar to that of *Vahlkampfia*, the only difference being that the *Craigia* has a smaller karyosome. In some of the larger organisms, an accessory nuclear body appears as a minute bright glistening oval body, near or in contact with the nucleus. It stains a deep black with iron hematoxylon. Organisms undergoing division are frequently observed, the accessory nuclear body dividing first. Two distinct nuclei are sometimes observed.

In the precystic stage, motility is lost; the organism contracts and expels all extraneous matter, and then rotates rapidly about its own axis,—sometimes for as long as an hour, but usually about 15 minutes, when a double cyst wall will have been formed, while the nucleus and accessory body are still to be seen. When fully developed, the cysts are refractive, spherical bodies, about 15 microns in diameter, with a well defined cyst wall and containing numerous very refractive spherical bodies, which eventually become the young flagellates. Both the cysts and swimmers stain so intensely that no fine details can be made out.

Morphology of *Craigia migrans*.

The life cycle of *C. migrans* differs from that of *C. hominis*, in that instead of dividing for a while as an amœba, then encysting, forming swimmers, and dividing for a while as flagellates; each flagellate, on attaining full development becomes an amœba without dividing; and each amœba encysts and produces a number of flagellates. This organism may have to be placed in another genus eventually.

Otherwise the life history is practically identical with that of *C. hominis*. Certain details are still lacking, but the following stages have been observed:

Beginning as a small spherical body, from 3 to 7 microns in diameter, average about 5, with the chromatin arranged in a ring at the periphery, the young form develops a brightly refractive granule in the center. This enlarges and divides, so that the sphere is filled with refractive granules. A pointed process of the outer wall of the sphere is protruded, and a flagellum is formed, and as soon as this occurs the organism assumes a pyriform or boat-shaped form, and moves in a jerky fashion, which is precisely similar to that of *C. hominis*. Until fully developed, there is no definite nucleus, but the protoplasm is filled with brightly refractive granules which take a basic stain with the Romanowski stain, and a very intense nuclear stain with iron-hematoxylin. When nearly at full development there may be seen near the base of the projection which bears the flagellum, a particularly heavy mass of this material, which may occasionally be demonstrated to contain a minute dot or rod of acidophilic chromatin. The organism is now slightly flattened from above downward, and just in front of this refractile mass, in some of them, may be seen a slight depression on the under side, around which the granules are not so closely packed. This depression gives the impression of being a rudimentary cytostome, but is certainly not a true cytostome, and indeed can only be seen in some of the swimmers, even when observed until they have turned in every possible position. In a well stained specimen, with either the Romanowski or iron hematoxylin stain, the flagellum takes a peculiar banded staining, which, at first glance, resembles a chain of bacteria. The

flagellum of *C. hominis*, if it stains at all, never shows this appearance and is much more delicate throughout than that of *C. migrans*, which is really a flagellum mounted on a projection of the outer membrane. When almost fully developed, a nucleus measuring about 4 microns in diameter is formed at the extreme anterior end, which has the general structure of the nuclei of the amoebic forms, except that there is much less chromatin, and the karyosome is smaller. The swarmer now begins to show more or less amoebic movement, and when in a mass of debris will almost throw out a pseudopod while, when in free fluid, it moves less actively and shows a fondness for rotating around its own axis without progressing. The beginning of a definite ectoplasm can be seen in the pseudopodia; the nucleus is more distinct; the flagellum is lost, and the flagellate becomes a small sluggish amoeba, usually about 12 microns in diameter. As a usual thing, even at this stage, the ectoplasm is easily seen when the organism is moving.

In the amoebic stage the size varies from 12 to 30 microns, averaging about 20. At rest, it is round or oval, and varies but little from this shape, even when moving, as there is rarely more than one pseudopod projected at a time, and this one is usually blunt, resembling that of *E. histolytica*.

In the smaller amoebas, motion is very sluggish; in the larger, it is active and always progressive. There is a sharper distinction of endoplasm and ectoplasm than in *C. hominis*. It can be observed in the larger forms even when at rest, and in the small forms when in motion. The ectoplasm is very clear and pellucid. There is no distinction in stained specimens. The nucleus can practically always be distinguished. The nuclear membrane is very distinct, having on its inner side dots of chromatin, smaller than those of *C. hominis*, and a somewhat more distinct karyosome, without a centrosome. The accessory body has not been observed. The nucleus is more strikingly of the *Vahlkampfi* type than that of *C. hominis*,—so much so that this structure can be observed in the living form and affords the most valuable means of excluding a coexistent infection with *E. histolytica*, when studying the pathogenicity of the parasite. The nucleus is slightly larger than that of *C. hominis*. This organism promptly

enters the precystic stage under unfavorable conditions and is then difficult to distinguish from other forms. The same rotation occurs as is described by Craig in *C. hominis*. The most careful observation failed to ascertain the mechanism by which this rotation is accomplished. Sometimes the first stages of cyst formation occur while the organism is still motile. The nucleus disappears and the organism gradually becomes filled with refractive spherical bodies, like that of *C. hominis*. The cyst is somewhat larger than that of *C. hominis*, averaging about 18 microns. The young swarmers are somewhat larger than those of *C. hominis*,—the usual size being about 5 microns. The cysts, therefore, contain from 20 to 30 young forms. The most of the round forms in the cysts of *C. hominis* are about $3\frac{1}{2}$ microns in diameter, and there are 40 or more in a cyst.

Differentiation of the Parasites.

"*C. hominis* is distinguished from either *E. histolytica* or *E. coli* by its small size, the character of the nucleus, the presence of an accessory nuclear body, the structure of the cysts, and the production of swarmers within the cysts. From *T. intestinalis*, it is distinguished, in the flagellate stage, by its larger size, the absence of an undulating membrane, the single flagellum, and the spherical shape. In the amœbic stage, it is distinguished from the resting forms of *T. intestinalis*, which sometimes possess a very limited amœboid motion, by the larger size and very active progressive motion, which is never observed in trichomonads. The differential points mentioned also serve to distinguish *C. hominis* from any entameba or intestinal flagellate hitherto described." (Craig.)

From *Chilomastix mesnili* it is distinguished by having but one flagellum instead of three, an amœboid stage of development, and its larger size; from *Prowazekia* by one flagellum instead of two, its amœbic stage of development, and the formation of swarmers within the cyst.

It may be distinguished from *C. migrans* by the smaller size of the youngest swarmers, and the greater size of the larger; by the shape of the swarmers; by the finer flagellum; by the smaller and less numerous refractile granules, and by the presence of the nucleus in the youngest swarmers; in the cystic stage by the smaller size and by the smaller and more numerous rings; in the amœbic stage by the smaller proportion of ectoplasm, by

the irregular shape, smaller size, smaller nucleus, and smaller karyosome.

C. migrans is distinguished from *E. coli* by its progressive motion, clear glass-like ectoplasm, and regular form, and by its frequently containing one or more red cells, and by the character of the nucleus. The presence of characteristic cysts and flagellates should prevent any error.

From *E. histolytica*, by the cysts and swarmers; by its smaller size; more abundant ectoplasm, and the almost invariable presence of the characteristic nucleus. The amœbic forms should not be confused with anything except the small forms of *E. histolytica*. The swarmers may be distinguished from *T. intestinalis* by their more boat-shaped form, as contrasted with the more pyriform shape of *T. intestinalis*; by the larger size; the absence of visible nucleus until fully developed; by the absence of vacuoles, and the presence of numerous large highly refractive granules; by the location of the nucleus at the extreme anterior end; by the single flagellum, by the absence of an undulating membrane and by the invariable presence, if diligently searched for, of the characteristic amœbas and cysts. These points would also distinguish it from *Cercomonas*.

It is of course possible that both forms of *Craigia* might occur either together or with one or both of the entamebæ. Such cases would prove very puzzling to anyone not familiar with *Craigia*, but the distinction would be of no practical importance, as in the case of infection with one or all of *C. hominis*, *C. migrans*, or *E. histolytica*, treatment must be pushed until the patient is entirely free from amœbæ, cysts and flagellates, of any or all of the species.

In the studies made for this report, in order to be sure that the symptoms were to be ascribed to *Craigia*, it was necessary to exclude *E. histolytica*. When all of the amœbæ were in the vegetative stage, the character of the nucleus was found a quick and rapid means of certain diagnosis. In the precystic stage, an ordinary stain affords a means of excluding *E. histolytica*, as the organism shows the intense affinity for the stain which characterizes the cystic stage, as soon as the typical nucleus is lost, and a brief glance is sufficient to show that it is not *E. histolytica*.

Morbid Anatomy.

None of the cases have come to autopsy, and therefore descriptions of the lesions are impossible. The writer has made many hundreds of examinations in the course of the work done against hookworm, and in all of them a number of slides were examined carefully with the high power. The conditions of the work were such that all of the specimens were fresh. Neither variety of *Craigia* was present, except in the cases mentioned above, and all of these cases contained gross or microscopic blood in the feces, which disappeared after removal of the parasites. A comparison of the symptoms with those of *E. histolytica* would, therefore, suggest that the morbid anatomy is similar; but that the destructive process is less extensive and less rapid. A patient may carry *Craigia* for months before seeking medical aid, but the infection, although in the beginning mild and insidious, is fully as dangerous as that of *E. histolytica* to the patient, and even more so to the community, as it is much more common for a patient with *Craigiasis* to remain a carrier for years than is the case in entamebiasis. The morbid anatomy indicated by the symptoms and by analogy, would be comparatively superficial ulcerations of any or all parts of the small and large intestines, with a tendency to the formation of abscesses in the liver, and possibly in the spleen or lungs. Secondary changes in other parts of the body, due either to intoxication from the derangement of function of these organs, or to the entrance of bacteria in the lesions produced by the parasites, may occasionally occur.

Symptoms.

It should be mentioned that the cases cited are on the average as severe as the corresponding cases of infections with *E. histolytica*, of which there have been 76 during the same period. Any case presenting symptoms referable to the intestines or the liver is in our work at once suspected of infection with some intestinal parasite, and an examination of the feces is made. Therefore, at least 90% of these cases of either entamebiasis or *Craigiasis* are of the mild or moderate varieties.

"The patients complain of some lassitude, mild headache, more or less indefinite abdominal discomfort, or dyspepsia. Slight intestinal disturbances, consisting of moderate diarrhea, or of constipation, may appear.

Such symptoms may appear singly or in various combinations; they may continue for months, and one may doubt whether they are all dependent upon the intestinal infection. Occasionally the abdominal pains become severe, or there may be an outbreak of diarrhea, which causes the physician to examine the stools," when the parasite will be found, with mucus or red cells.

There have been none of this series which corresponded to the cases of amœbic dysentery with acute onset.

"Advanced and chronic cases. In the advanced stages of the disease, the symptoms become well marked. The movements become more frequent and usually contain much mucus and frequently blood. Their number may vary from two or three in the morning to ten or fifteen, or more, during the day. There is aching in the back, and at times a sudden and intense desire to defecate. As the disease becomes chronic, loss of weight is progressive and, finally, marked emaciation may result (Cases 14 and 22). There is more or less anorexia, and indigestion and flatulence are common. Another type of the chronic form is that in which there is nothing more than an intermittent diarrhea often intermitting with constipation."

Special Symptoms.

"Diarrhea is the most important, usually being intermittent in character, coming on abruptly, and subsiding in like manner. Between the attacks, the stools may become formed."

The intermissions of the diarrhœa are seldom of more than a week, as contrasted with entamebiasis; but in one case an intermission of three months was reported.

"The stools vary greatly. At times they are liquid, at times pultaceous, and at times well formed. In color they may be brownish, reddish, greenish, or variegated. As the lesions develop, mucus begins to appear. At times the stools may consist entirely of viscid masses of blood-stained mucus."

In other words, the only distinction between the stools of *Craigiasis* and entamebiasis is that in the latter severe hemorrhages occur more frequently.

Indefinite abdominal pain and tenderness are present in nearly every case. Tenesmus is not as common as in entamebic dysentery, and the severe colicky pains are not frequently complained of. Circumscribed pain and tenderness are encountered most often in the region of the pylorus (Case 24 an extreme example), also in the neighborhood of the appendix, or of the sigmoid flexure.

"Loss of appetite is common."

The tongue, skin, pulse, respiration, and urine are usually unaltered; in severe cases they may show the changes consequent upon the constitutional disturbance.

Only one case was free from other intestinal parasites. This case presented an eosinophilia of 14%. All of the severe cases show an anemia. Slight fever is usually present at the commencement of an attack of diarrhœa, and during a severe attack; and a severe, irregular fever may be present in cases of hepatic or pulmonary abscess.

Complications.

Abscess of the liver. Out of the 56 cases of the series, there have been (cases, 1, 4, 14, 22, 24, 25, 26, and four of the earlier cases) 11 cases of undoubted advanced or incipient abscess of the liver. Among the 76 cases of entamebiasis treated during the same period, there were but 3 cases suggesting liver abscess.

The symptom of which most complaint is made is pain in the right side of the chest, or under the right scapula; the liver is more or less enlarged and tender. The spleen is not usually enlarged, unless there has been malaria or uncinariasis, or both. An irregular fever is usually present, which in acute cases may be so sharp that in connection with the accompanying chills, it may suggest a malaria.

Pulmonary abscess. Only one case occurred (case 4). The symptoms are described below, and did not differ from those of hepato-pulmonary abscess of entamebic origin.

Appendicitis. Cases 13, 18, and two of the unreported cases, had such marked pain and tenderness in the region of the appendix that there is but little doubt that had the diagnosis *Craigiasis* not been made, and the symptoms increased in severity, the diagnosis of appendicitis would have been inevitable. About 7% of the advanced cases of entamebic dysentery show this complication and the incidence in *Craigiasis* seems to be about equal.

Arthritis. The writer has been collecting a series of cases for several years which seem to show that in susceptible individuals various intestinal parasites may be the direct or indirect cause of the hypertrophic forms of arthritis deformans, and in case 13,

which was very carefully studied, both the clinical findings and the results of treatment would seem to indicate that, in those predisposed, infection with *Craigia* may have a similar result. The writer believes that this result is due to the associated bacteria rather than to the animal parasites.

Duodenal ulcer. Cases 10, 13 and 24, and one of the unreported cases, might all of them, from the symptoms, have been easily diagnosed as duodenal ulcer, and in fact they undoubtedly were ulcers of parasitic origin. It seems from the symptoms and the frequency with which the parasites can be obtained by a purge, in cases in which there are few or none in the ordinary stools, that the usual place of first infection is in the small intestine, and it can be readily understood that if a parasitic ulcer were located near enough to the pylorus to be subjected to the acid contents of the stomach, the symptoms would be indistinguishable from those of ordinary duodenal ulcer.

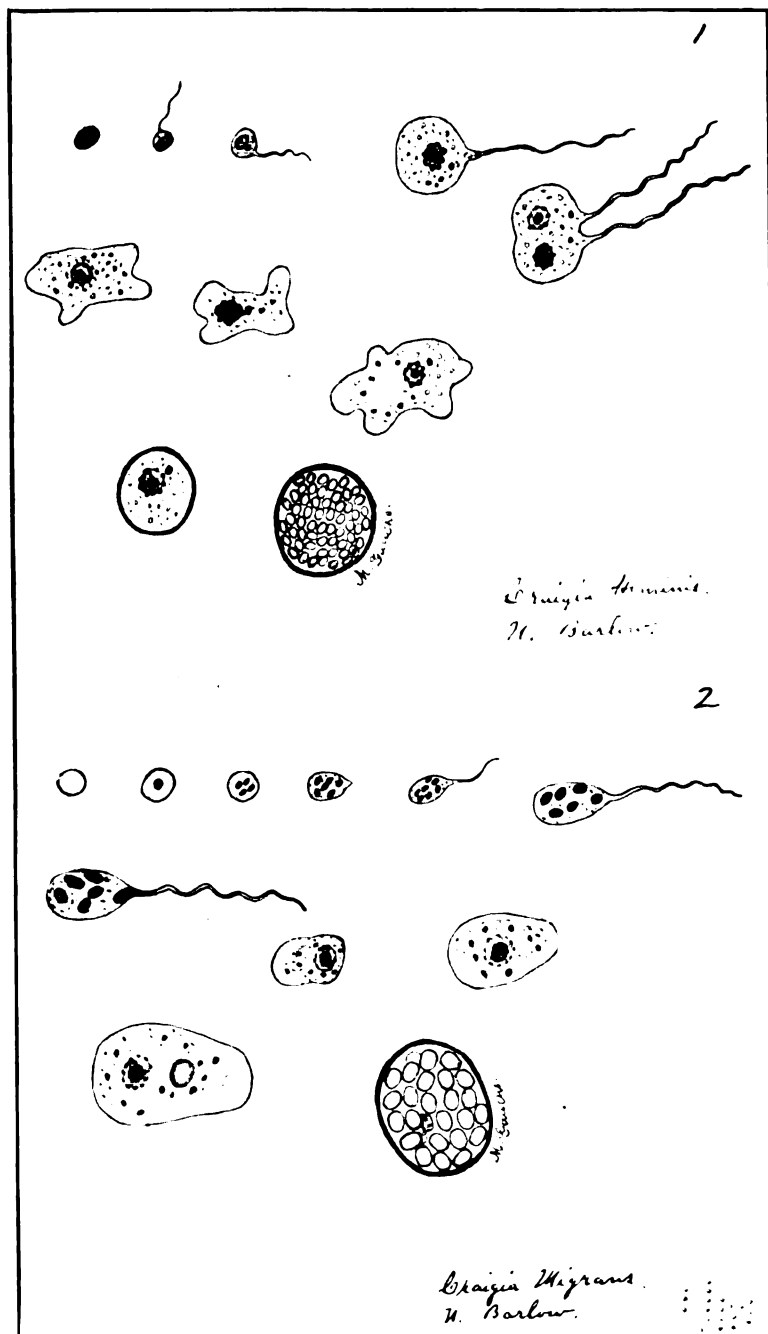
Metastatic infections in various parts of the body. There have been a number of cases in which the symptoms have indicated that *Craigia* is prone to produce lesions in various parts of the body, which if secondarily infected, may result in abscess; but as the cases were none of them worked out to the point of complete demonstration, they are not included in the report.

Pain in the back. Cases 17 and 18 illustrate this complication.

Pruritus occurred in one case (case 17) which was relieved by the cure of the infection.

Pain in the long bones. The writer is entirely unable to explain the pain in the bones and the presence of myelocytes in the blood of case 19, but as it was entirely relieved by the cure of the infection for *Craigia*, it must have been in some way dependent upon it.

Hæmorrhoids. There were two cases who came for consultation on account of what they supposed to be hæmorrhoids. In these cases, a few moderate sized piles were found; but as the symptoms were relieved by the removal of the parasites, and as the hæmorrhoids were not to be seen at a later date, it seems that true hæmorrhoids maybe either stimulated, produced, or aggravated, by the straining or congestion accompanying the tenesmus present in infections of the rectum with *Craigia*.



ILLUSTRATING ARTICLE OF DR. BARLOW

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Diagnosis.

The diagnosis can only be made by finding the parasites in the feces. The swarmers are the most conspicuous objects imaginable, and doubtless have often been seen and regarded as cercomonads or trichomonads, the amœbic forms having been taken for *E. coli* in the case of *C. hominis*, and for *E. histolytica* in the case of *C. migrans*.

The clinical diagnosis is almost impossible. In the description of symptoms the quotations are taken directly from an article by Strong, in a standard text-book upon entamebic dysentery⁵, and apply equally well to Craigiasis, in fact they express the symptoms better than the original description which the writer produced, and, for this reason, I have taken the liberty of quoting them *in extenso*.

There is no doubt that many cases are unrecognized, cause long suffering, or even death, after being treated for various other conditions, or even sent to the operating table. It should be emphatically stated, that no physician does his full duty who fails to examine the stools of all cases occurring in the tropical or subtropical region, who suffer from any of the following symptoms: indigestion, diarrhœa, pain in the back, enlarged or tender liver or spleen, dry chronic cough, hæmorrhoids, pain under the right scapula, or in the region of the liver; nor should any of the following diagnoses be made, until after an examination of the feces: appendicitis, cirrhosis of the liver, hepatitis, gastric or duodenal ulcer, or any variety whatever of enteritis or colitis.

Prognosis.

Although somewhat more insidious in its development, and although in the first stages not as distressing, Craigiasis is certainly as dangerous a disease as entamebiasis.

There have been 76 cases of the latter disease treated in this hospital since February 1, 1914. All of them made perfect recoveries, and all but one remained free from relapse; this one developed an abscess of the liver three months after treatment. The abscess yielded to treatment and the patient is now well.

In the same period there have been 56 cases of Craigiasis, all of whom were as thoroughly, or more thoroughly, treated,

except in the cases who disappeared during treatment. Among these there has been one death, one patient whose life was for a time despaired of, and who is not yet well. Four other cases had relapses after very thorough treatment.

In the cases of infection with *E. histolytica*, there were only 3 cases of liver abscess, while among the smaller number of infections with *Craigia* there were 11. The cases of *C. hominis* were too few to compare with those of *C. migrans*; but as far as can be judged, it seems that *C. hominis* is more difficult to remove from the body than *C. migrans*; that it is more prone to cause distressing diarrhœa or dysentery, but less likely to cause metastatic infections than is *C. migrans*. It is the opinion of the writer that any infection with either of the species of *Craigia* would probably be ultimately fatal, if untreated,—although after an indefinite period and quite likely without producing marked dysenteric symptoms.

Treatment.

During the early part of the work various treatments were tried. Many of them were very successful in removing the parasite from the feces for a time, and often the symptoms were ameliorated. Among them may be mentioned quinin, silver nitrate, thymol, calomel, santonin, magnesium sulphate, male fern, bismuth, salol, and methylen blue,—singly and in various combinations. The only effective treatment was found to be either emetin, hypodermically, or ipecac, internally.

The treatment should be pushed to large doses and continued for a long time. Two grains of emetin a day for two weeks, in cases of liver abscess, should be sufficient. In intestinal cases, the simultaneous administration of emetin hypodermically, 1 grain, with corresponding doses of ipecac internally, in some form which reaches the intestine before becoming active, was found most efficient.

Except in cases of hepatic abscess, oral administration of ipecac was found more promptly efficient than the use of emetin, probably because of the simultaneous existence of amebic forms living within the tissues, of cysts which are probably unaffected by treatment, and of free-living swimmers which are not affected by the emetin present in the blood stream. Complete

and permanent cure is more promptly effected if the treatment by ipecac and emetin is accompanied by occasional flushing of the bowels with saline laxatives, to remove the cysts and flagellates.

In giving ipecac by oral administration, if there is diarrhœa, it should be controlled by opium to prevent the too prompt excretion of the ipecac. Except in severe cases, nothing is gained by a rigid diet.

Concurrent affections, as malaria, etc., may be simultaneously treated without impairing the efficiency of either treatment. The writer has not seen any bad effect from the daily administration of both two grains of emetin and fifteen of quinin. If hookworm is also present, the usual treatment, given near the close of the ipecac treatment, will very effectually cleanse the intestines of any cysts or flagellates that might have escaped. Special symptoms are usually so promptly relieved by the cure of the underlying infection that other medication is unnecessary.

Case Reports.

Case 1.—Paul Peule, French negro, presented March 15, 1914. Had suffered several months with cramping pains in the abdomen, severe pain in the region of the liver, and pain in the right shoulder. Had been losing weight, and for two weeks had been unable to work on account of fever and pain.

Examination showed an irregularly enlarged liver, and general abdominal tenderness. The blood was negative, with the exception of 14% of eosinophiles. Examination of the feces revealed the ova of *Trichuris*, a peculiar amœba, which was considered a form of *histolytica*, and a *Cercomonas*.

The description of the amœba and *Cercomonas* correspond exactly with the description of *Craigia migrans*, as given above.

A diagnosis of abscess of the liver was made. The patient was placed upon injections of emetin, 2 grains for two weeks. Complete recovery resulted, and both the amœbæ and swimmers disappeared from the stools after the fifth day. The patient has remained free from relapse.

Case 2.—Child of Jorge Comacho, native; age, two years. Suffering from intermittent fever and bloody diarrhœa. Æstivo-autumnal parasite found in the blood. After two weeks of quinin treatment, the fever entirely disappeared. The bloody diarrhœa continued, and examination of the stools showed *Ascaris* and the same amœba and flagellated form as in Case 1.

Two weeks of injections of one-third grain of emetin daily resulted in the cure of the dysentery and disappearance of both forms of the parasite. Patient was discharged as cured, June 28.

December 17, the child was brought to the hospital with a diarrhea and great numbers of *Craigia migrans* were found in the feces. The diarrhea was relieved in four days by the administration of alcresta ipecac, 1 tablet 3 times daily. The baby is still under treatment.

Case 3.—Cecilio Mendez, native; age, 26. Had suffered for some time with "indigestion;" now had a diarrhea with cramping pain and tenesmus. Blood negative for malaria. Stools showed ova of hookworm and the *Cercomonas*-like form of the above cases.

Thymol was administered, followed by a course of magnesium sulphate and bismuth. Temporary relief was obtained. Three weeks later, the patient reported with a severe diarrhea. Large numbers of swarmers were found, and what was taken for *E. histolytica*. A two-weeks course of emetin resulted in complete relief and in the disappearance of both forms of the parasite.

Case 4.—Z. D., white; age, 3. Was first seen February 8, 1914, suffering from irregular fever. Blood examination revealed the æstivo-autumnal parasite, and a course of quinin was given. The child rapidly regained health and seemed perfectly well, except for a loose condition of the bowels.

Examination of the feces showed only the "*Cercomonas*" form of *Craigia migrans*. As *Cercomonas* is stated to be a harmless parasite, it was supposed that the diarrhea was a sequel of the malaria, and the parents were reassured as to the outcome.

Early in September, the child was suddenly taken with chill and fever. The liver was found enlarged, with a very definite rounded fluctuating mass about the size of an orange connected to it. There was severe pain and extreme tenderness of the liver. There was no cough, difficulty of breathing, or bronchial breathing at the base of the right lung.

Examination of the feces showed the swarmers and amœbic cysts. Injections of emetin, one-third grain daily for 5 days, resulted in relief of the pain and fever. The injections were temporarily discontinued on account of the objections of the child, who, after one week, again showed fever and pain; but of a different character. Examination now showed a regular and not tender liver; dullness with absent breath sounds over the lower part of the right lung, with cough and expectoration of a very putrid, sometimes blood-stained pus, in great quantities.

On being warned of the possible necessity of operation, and on account of the somewhat imperfect hospital facilities here, the mother decided to take the girl to the States. Alcresta ipecac was given for administration on the trip. The child improved wonderfully on the boat and after a few days of observation in the hospital, the surgeons of the States were of the opinion that the child would recover without operation, and she was discharged from the hospital.

The surgeon in charge of the case wrote that after a few days of improvement the child was suddenly taken with fever, and operation was

deemed the only hope of relief. The child died the eighth day after the operation.

Although at the time the child left for the States, it had been recognized that the case was one of infection with *Craigia*, it was believed that this term would convey no meaning to the average surgeon and the case was reported to him as one of amœbic dysentery. The ipecac treatment was not continued in the States.

In view of the great improvement which the child made after first the use of emetin, and second ipecac, it seems possible that a persistent use of these preparations in maximum doses might have produced a different result. This is not intended as a criticism of the surgeon in charge, as it had been the intention of the writer to operate under the same conditions that the operation was performed in the States, and at that time the writer did not urge, either upon the parents or upon the surgeon to whom the case was referred, the energetic use of ipecac which it now seems might have averted a fatal result.

Distance precluded the examination of the fresh sputum, and no autopsy was held; but this case would suggest that possibly some of the recorded cases of *Cercomonas*, found in pulmonary abscess, were really cases of some species of *Craigia*.

Case 5.—Boy of 14 months; severe infection with æstivo-autumnal malaria. After prolonged treatment with quinin, the malarial symptoms disappeared; but a mucous diarrhea, with occasional slight fever, persisted.

The stools showed the same forms as were found later in his sister, *Case 4*. Two weeks of injections of one-sixth daily of emetin, resulted in complete relief of the symptoms, and in the disappearance of the parasites. The boy is now strong and well.

Case 6.—Washington Brown, a negro. Complained of pain in the region of the liver and in the right shoulder.

Examination showed an enlarged and tender liver. There was no malaria, and only 100° F. temperature. The feces contained *Craigia migrans*. Injections of 1 grain of emetin for 10 days resulted in relief of the symptoms and disappearance of the parasites.

Diagnosis.—Incipient abscess of liver from infection with *Craigia*. July 18, after 10 days of treatment, he ceased reporting. There has been no relapse.

Case 7.—Two-year-old child of Fernando Cruz, native. First seen July 12, 1914. Suffered from slight diarrhea; cried a great deal, and would not eat. There was no fever, but the mother stated that at times the child seemed hot. The feces showed *C. migrans*. Daily injections of one-third grain of emetin resulted in complete relief of symptoms and in disappearance of the parasites. There has been no return of the symptoms.

Case 8.—Three-year-old child of C. Carson, negro, seen August 5, 1914. Child suffered with severe diarrhea; great pain at the time of defecation; anorexia, and slight fever. Had been ill about three months. There was no malaria. The stools contained large number of *Craigia hominis*.

A two-weeks course of emetin, one-third grain daily, relieved the symptoms and almost entirely removed the parasites—a few swimmers still being seen.

The parents were unwilling to continue the treatment. During the month of September, the child had very loose bowels, and in October was again ill with the same symptoms as in the first place. The father had just arranged to resume treatment when the family moved away.

Case 9.—Three-year-old child of F. Ruben, native. Had suffered two months with severe diarrhea and cramping pain at the time of defecation. No malaria. The stools contained swimmers and amoeba of *Craigia migrans*, and red blood cells.

Two weeks of injections with one-third grain daily of emetin, resulted in the relief of the symptoms. The child has remained well. First seen August 14, 1914.

Case 10.—Miguel Dwarte, adult native; reported August 14, 1914, complaining of a severe vomiting for one week, which had reached a point where he could not retain anything but a little water. No malaria.

Physical examination, negative, except for diffuse tenderness in the pyloric region. Stools contained *C. migrans*.

After three injections of 1 grain of emetin, the vomiting ceased, and patient felt perfectly well. Two weeks' treatment of one grain daily was given. The abdominal tenderness disappeared, and the parasites were removed from the stools. The patient has remained well.

Case 11.—One-year-old baby of Carlos Murillo, native. Had been suffering for some time with a severe mucous diarrhea and occasional blood in the stools. Fever and malaria coexisted. The parents could not be induced to bring a fresh sample of the stools, and cocoa-quinin was given for one month.

August 18 the child was again brought. The fever had disappeared; but the diarrhea was much worse and at times there was considerable blood in the stools. *C. migrans* was found on examination.

The symptoms were relieved by seven injections of one-third grain emetin, and the parents failed to bring the child for further injections. The father now reports that the child is again suffering from diarrhea, with some blood in the stools, but refuses to bring a sample of the feces, as he fears that bringing a specimen will make necessary an expensive treatment, having had that experience with himself and the child, as reported below.

Case 12.—Mrs. D., mother of Cases 4 and 5, had taken a four-months treatment for æstivo-autumnal malaria. She reported August 20, 1914, suffering with intestinal pains, which had been troubling her for some time; loss of appetite, and soft stools, two or three daily. General abdominal tenderness was present, most marked in the pyloric region. The stools contained *C. migrans*.

Two weeks of emetin, one grain daily, relieved the symptoms, and removed the parasites. The patient is now perfectly well.

Case 13.—Raimundo Garcia; native adult. Reported August 24, 1914, complaining of pain in the right elbow and shoulder and in the left knee. The temperature was normal, and he stated that he had no chills, fever nor sweats.

For the reasons stated in the body of this article, a most careful examination of this patient was made. The urine was negative. Physical examination showed the affected joints tender on pressure, with no perceptible increase in the synovial fluid, but with a slight periarticular thickening. A slight tenderness of the abdomen was elicited, most marked in the region of the appendix. The physical examination was otherwise negative.

The hemoglobin was 75%. The differential count:

Polys	68
Large monos.....	2
Small monos.....	16
Eosinophiles	14

History, negative. On careful questioning, patient stated that he sometimes felt slight pains in the abdomen. The bowels were perfectly regular, with two soft movements daily. The stools contained *C. migrans* and after a most careful search no other parasite could be found.

He was given seven injections of one grain of emetin. The pain entirely disappeared, both in the joints and in the abdomen, and the parasites were removed from the stools. The patient ceased reporting. When seen one month later, he was feeling well, and the joints appeared normal.

Case 14.—Dionysio Ramirez, aged 40, native. First seen September 2, 1914. Gave history of attacks of diarrhea lasting from three to ten days, at irregular intervals, for the last three years, becoming more severe of late. There was general abdominal tenderness, more marked in the region of the pylorus. *C. migrans* was found in the stools. On close questioning, he admitted that he suffered more or less from cramping pains and stated that he often did not feel like work.

After six injections of one grain of emetin, he disappeared. When seen two months later, he stated that the diarrhea had not returned and that he was feeling stronger than he had for three years previous.

Case 15.—Fernan Hernandez, adult native. First seen September 3, 1914. Complained of pain in the region of the liver and in the right shoulder; nausea, vomiting, and anorexia. General abdominal tenderness, most marked in region of the liver. Liver from fourth rib in nipple line, to 3 inches below costal margin. Slight irregular fever, 101° F. Stools contained *C. migrans*.

Two weeks of emetin injections resulted in relief of pain and return of the liver to almost normal size. It was impossible to keep the patient longer under control. When last heard from, he was feeling well.

It is remarkable that this patient denied any history of diarrhea, and when first seen was, in fact, constipated.

Case 16.—Humberto Lopez; adult native. First seen in the latter part of August by my assistant. Had been suffering for some time with

diarrhea, which, during the last month, had usually been bloody, but with no great hemorrhage. As no amœbæ were found, he was treated for about two weeks with calomel, magnesium sulphate, bismuth, salol, etc., and a treatment with thymol was given for hookworm.

September 4, 1914, the diarrhea was almost incessant, with severe pain and tenesmus and a small amount of blood in each stool. There was rarely any fever, but the pain and distress of the patient were comparable to that of a very severe case of entamœbic dysentery, although but little blood was passed.

Examination of the stools revealed enormous numbers of *C. migrans*. By this time the writer was familiar with some of the differential points between the amœbic stage of *C. migrans* and *E. histolytica*, and made a careful search for the latter parasite; but was unable to find it.

Two weeks' treatment completely relieved the symptoms. The patient left the plantation shortly afterwards and has not since been heard from.

Case 17.—Ricardo Sanchez, adult native. First seen September 10, complaining of severe pain in the lumbar region and intense itching in all parts of his body. There was no abdominal pain, and only one formed stool daily. Examination was negative, except for slight general abdominal tenderness. No lesion of the skin was seen.

After four injections of emetin, the pain was entirely relieved and the prurigo had disappeared. After eight injections, the parasites (*C. migrans*) had disappeared from the feces. The patient has left the neighborhood.

Case 18.—Carlos Murillo, father of Case 11; age 27, reported September 16, 1914, as having suffered from pain in the back for several weeks. He had no abdominal pain, but passed two or three soft movements daily. The stools contained *C. migrans*.

Physical examination showed abdominal tenderness in the region of the appendix.

After five days of emetin injections of 1 grain, the pain in the back, the abdominal tenderness, and the parasites, had all disappeared. Search for *E. histolytica* was unsuccessful.

Case 19.—Florencio Sanchez; native; age 53. Had suffered for the last three years with a constant diarrhea, accompanied with cramping pain in the abdomen. He had tried every remedy that he could command, and despaired of cure. For the last five days he had suffered from severe pains "in the bones" of the legs.

Examination revealed great tenderness over the entire abdomen. The legs were objectively normal. The feces contained great numbers of *C. migrans* and a few hookworm ova.

The hemoglobin percentage was 45.

The blood count:

Polymorphonuclears	50
Large lymphocytes	0
Small lymphocytes	34

Eosinophiles	12
Undoubted myelocytes	4

After one grain of emetin injected three times, the pain in all the bones, the diarrhea, and the pain in the abdomen, had all disappeared.

The patient did not return for further treatment; but was seen three weeks later. He considered himself well. A specimen secured at this time was free from *Craigia* and no myelocytes were to be seen in the blood.

Case 20.—J. D., father of Cases 3 and 5, American. Reported October 5, 1913. Had suffered one week with diarrhea and abdominal cramps. *C. migrans* was found in the stools. The abdomen was tender, particularly in the region of the sigmoid.

Fourteen injections of one grain resulted in complete relief and in the disappearance of the parasites.

Case 21.—A. H., German, aged 28. Reported October 12, 1912. Had suffered eight days with diarrhea and abdominal cramps. *C. migrans* was found in the stools.

After taking six tablets of alcrestia ipecac, the pains all disappeared. After one week's treatment of nine tablets daily, the patient was free from parasites, and has remained well.

Case 22.—Wife of Juan Rivera; native, ag, about 22. Reported October 9, 1914, suffering with a very severe diarrhea, with cramping pains and tenesmus, as severe as in any case of entamebiasis; but with only a small amount of blood. The patient was emaciated, very weak, and with no appetite. The stools were loaded with *C. hominis*.

Combined treatment with emetin and alcrestia ipecac was continued for four weeks, when improvement commenced and at the same time the number of the parasites became much reduced.

The parasites never entirely disappeared, in spite of the use of all the auxiliary treatments. Improvement and coincident reduction of the parasites continued from November 25 until December 6, when a tertian malaria became manifest, and after two chills the patient reported with the parasites again present in large numbers and with the dysenteric condition as grave as ever, with the added burden of malarial fever.

The patient also suffered from hookworm and *Ascaris*. These were not present in large numbers, but must have influenced the result. In spite of the most careful treatment, the present prognosis in this case is death; although the malaria has been subdued, the *Craigia* are present in apparently undiminished numbers, and the patient is losing strength.

Case 23.—José Rodriguez; native; aged 34. Reported October 14, 1914, stating that he had bruised his right side and that it had been paining him for the last week. No other history could be elicited.

Examination showed a slightly enlarged and tender liver. *C. migrans* was found in the stools. He was placed upon alcrestia ipecac. After two days the pain and the parasites had both disappeared. Treatment was continued for ten days, for safety. The patient has remained well.

Case 24.—Ismail Villareal; native; age, 47. Reported December 14,

1914. He complained of severe pain in the stomach, coming on an hour after eating; of occasional vomiting of a sour material; and of constipation. He admitted occasional diarrhea, slight.

Examination showed abdominal tenderness, very marked in the region of the pylorus, where the resistance of the muscle precluded thorough examination; but the impression was given of a small nodule. He was much emaciated. The stools contained *C. migrans*, swimmers only in the normal stools; but after a purge, the amœbic forms were also to be found.

After four injections of emetin, with internal administration of alcresta ipecas, the pain, vomiting, nausea, abdominal tenderness and rigidity, have all disappeared, coincident with the disappearance of the parasites.

The impression of a small nodule in the pyloric region was still given; but on examination at a later date, it could not be felt.

Case 25.—Enecon Martinez; native; age, 19. Presented December 24, 1914. For nine days previous had felt pain in the region of the liver and under the right scapula; with a troublesome dry cough.

Examination showed both liver and spleen enlarged and tender. The feces contained ova of hookworm and lumbricoid worms. Santonin and thymol were administered, and *C. migrans* appeared in the stools brought by the purge. After four injections of one grain each of emetin, the symptoms entirely disappeared, and both liver and spleen were much reduced in size.

Careful inquiry revealed that for one month previous, the patient had had a slight intermittent diarrhea, with abdominal discomfort.

Case 26.—Maria de la Cruz Barrona, native. First presented July 1, 1914, suffering from what appeared to be tubal abscess, but presented no evidence of past or present vaginitis or endometritis.

Treatment directed along the usual lines, with removal of ascarides and hookworm gave great symptomatic relief.

December 28, she presented with a much enlarged and tender liver; pain under right scapula; irregular fever and debility. On close questioning, admitted having suffered from constipation for several years, with occasional attacks of diarrhea, sometimes bloody, which always yielded readily to native remedies.

Three examinations were made, and in the last one *C. hominis* was found. Only a few parasites were encountered, and these only flagellates in the preamœbic stage.

She is still under treatment. This is the first case in which the writer has diagnosed Craigiasis from the symptoms and history alone.

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EXAMINATION OF ARRIVING ALIENS FOR UNCINARIASIS AT HONOLULU.

The Laboratory Equipment and Duties of Assistants; Collection of Specimens for Examination; Preparation of Microscopic Specimens; Rules for the Guidance of Assistants; Identification of Specimens; Examination of Slide Preparations; Further Examination and Treatment of Aliens Certified for Uncinariasis.

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The Laboratory Equipment, and Number and Duties of Assistants Required.

The laboratory provided by the Immigration Service for use in the medical examination of aliens arriving at the port of Honolulu, T. H., consists of three compartments in the main building at the Immigration Station; these compartments being specially designed with a view to facilitating the work of handling large numbers of aliens in an orderly manner, and at a minimum loss of time. The three units of the laboratory are immediately adjoining and consist of (1) a specimen collecting room, (2) a specimen preparing room, and (3) an examining room. The specimen collecting room is divided into eight small closets, four in one row for males, and four in another row for females. These are used for the collection of fecal specimens in a manner to be described presently. Each closet is 3 feet square by 6 feet high, thus allowing sufficient space for one person. All the closets are open at the top to permit light and ventilation, and a space of 4 inches is left unsealed between the walls and floor, except the outside wall, so as to allow the entire floor space of all eight closets to be flushed at one time with a garden hose attached to the water supply. The entire floor space is

covered with a specially prepared cement paint. All the closets are provided with doors so as to give sufficient privacy when being used. The specimen preparing room measures 9 feet wide, 10 feet deep, and 10 feet high, and is immediately adjoining the compartment above described for the collection of specimens. This room contains a specially selected slop sink for the final disposal of fecal material, etc. This sink is white enameled inside and out and supplied with a flushing rim encircling the top, and a water-closet cistern which provides an ample volume and force of water to ensure a thorough cleansing of all sides of the sink, and completely flushing the trap each time the apparatus is used. This fixture meets all the sanitary requirements of a combined slop sink and water-closet, viz: it does not allow the escape of sewer air from the soil pipe into the room; it is thoroughly and easily cleaned each time it is used; it has no hidden parts for the collection of filth; it is flushed out without the throwing of filth or spray into the air of the room; it has sufficient water supply to wash out the sink and trap each time and to refill the trap; and the trap itself is not siphoned or left empty by a discharge of water from this or another fixture. This room has a large rectangular window admitting plenty of light and ventilation. Fastened to the wall just in front of the window is a long hardwood work bench, upon which are placed the principal materials used in the preparation of the microscopic specimens, consisting of the following: an electric centrifuge carrying 4 tubes; a rack containing centrifuge tubes; two glass jars each containing 500 slides; two glass jars each containing 500 cover glasses (the slides and cover glasses are kept immersed in 95% alcohol); a glass jar containing a few glass pipettes immersed in 2% lysol solution; a small electric sterilizer; a thick glass slab painted black on the under side; and a box containing platinum needles, glass rods and other small odds and ends. The side walls are provided with several shelves upon which are kept numerous articles including a quantity of 2% lysol solution in large glass irrigating bottles; a copper-wire strainer, 40 strands to the inch, for straining fecal material; a large glass dish painted black upon the under side, for use in looking for worms discharged with the feces; an extra supply of microscopic

slides and cover glasses, and centrifuge tubes; a number of bottles containing reagents for testing the urine, and several varieties of aniline stains; and a supply of agateware chambers, and ordinary shipping tags for use in identifying the fecal specimens; and a quantity of 20% formalin solution for use in deodorizing the feces.

The examining room adjoins the specimen preparing room, with which it communicates by a door in the wall between the two, and is also of the same size. This room contains two large rectangular windows provided with large panes of glass; a microscope and accessories; a table and revolving chair.

The personnel of the laboratory consists of one medical examiner, one technical assistant, and one attendant.

The duties of the attendant are: to assemble the aliens to be examined outside the room where the specimens are to be collected, and maintain proper order and behavior among the aliens while the specimens are being obtained; to deliver to each alien a receptacle (agateware chamber) in which the feces are to be deposited, and an identification tag marked on one side with the name of the ship on which the alien arrived, the date of arrival, and the alien's manifest number; to conduct each alien to one of the small closets and there explain to him what he is required to do; to receive from each alien the receptacle containing the sample of his feces, with the identification tag attached, and deliver the same at once to the technical assistant.

The duties of the technical assisant are: to have charge of and assume responsibility for all materials used in the preparation of specimens, and conduct the work of preparing microscopic specimens under the direction of the medical examiner; to deliver to the medical examiner the specimens as they are prepared for microscopic examination; and to see that all parts of the laboratory are kept in a clean and orderly condition.

The duties of the medical examiner are: to have charge of and be responsible for the efficient conduct of all laboratory work, and supervise the duties of its personnel, under the direction of his commanding officer; to examine all microscopic specimens, and certify, for the information of the immigration offi-

cials, all aliens found to be afflicted with uncinariasis, or other diseased conditions requiring certification.

The Collection of Specimens for Examination.

The aliens to be examined for uncinariasis are assembled and arranged in order as they are listed upon the ships' manifest. Each alien is furnished with the receptacle, an ordinary agate-ware household chamber, and the identification tag previously mentioned. Having made the alien understand that he is required to furnish a sample of his feces to be deposited in the receptacle, he is admitted to one of the small closets. All eight closets are thus kept in constant use until the desired number of specimens have been obtained. Care is taken to prevent any conversation or communication between the aliens using adjoining closets. Each alien is required to deliver his receptacle containing his feces, not less than $\frac{1}{2}$ ounce, to the attendant, with the identification tag attached to the chamber. Upon receipt of the specimens the attendant at once delivers the same to the technical assistant. As each closet is vacated, and the specimens delivered, another alien is admitted, and so on, until the required number of specimens have been obtained. It has been found that about 50 specimens can be obtained in 30 minutes. Upon completion of the collection of the specimens, the entire floor space and the inside walls of the closets are flushed out with a hose connected with the station water supply. No odor or filth remains about the closets, and the location of the closets close to the outer wall of the building, the upper half of which is left entirely open to the outside air and sunshine, being covered only by a wire screen, secures a free circulation of fresh air at all times, and effectually prevents the accumulation of any excremental odor while the closets are being used.

The Preparation of Specimens for Microscopic Examination.

Upon receipt of the receptacle containing the fecal specimen the laboratory assistant immediately sprays the feces with a 20% formalin solution contained in an ordinary atomizer. This has been found to at once abolish the objectionable fecal odor. The assistant now takes the first four specimens that were received and with a glass rod removes about 2 grams of feces from each

of the four specimens, and transfers this amount to four clean centrifuge tubes. To each of the specimens removed to the centrifuge tubes there is added 5 cubic centimeters of a 2% aqueous solution of lysol, this being thoroughly mixed with the feces with a glass rod. The tubes are next placed in the centrifuge holders and the specimen centrifugalized at high speed for one minute. The tubes are now removed from the holders and all of the supernatant liquid in each of the tubes is carefully decanted so as not to disturb the sediment that has been thrown down during the foregoing process. Another 5 cubic centimeters of lysol solution is run into each tube and the sediment thoroughly mixed as before, after which the specimens are again centrifugalized for one minute at high speed. This process is carefully repeated three times, and upon the completion of the third centrifugalization, the supernatant liquid is decanted from all the tubes, and a small amount of the sediment is transferred to a clean glass slide. To this is added a small drop of aniline gentian-violet and the stained sediment covered with a cover-glass. The use of aniline gentian-violet has been found to add materially to the rapidity of making the microscopic examinations, owing to the fact that all the vegetable and other matter in the specimen is at once stained a dark blue or purple, leaving the hookworm eggs absolutely unstained, and thus enabling the examiner to proceed with greater rapidity in the examination than is advisable with the ordinary unstained specimen. The contrast in color between the hookworm eggs and all the other material in the specimen is very marked, so that the bringing of a hookworm egg anywhere in the microscopic field will at once attract the examiner's eye. The hookworm ova appear as the characteristic oval grayish segmented bodies in a field of dark blue and purple. It may also be mentioned that the ova of other intestinal animal parasites commonly found during the examination of feces for hookworm eggs, are likewise left unstained by the gentian-violet, for example, the ova of the *Trichuris trichiura*, as *Ascaris lumbricoides* retain their usual brown color. In very light, or suspected cases, of hookworm infection, the following technique of preparing microscopic specimens has given excellent results: About one ounce of feces is equally distributed

in four centrifuge tubes, and to each of these is added about 10 cubic centimeters of 2 per cent solution of lysol and thoroughly mixed with the feces. The four tubes are next centrifugalized at high speed for one minute, the supernatant liquid decanted, more lysol solution added, and this process continued three times. Thus far the method is the same as described above, except for the increased amount of feces and lysol solution used. Having poured off all the supernatant liquid after the completion of the third centrifugalization, all the sediment contained in the four tubes is now transferred to one of the tubes, and the centrifugalization repeated three times more as above described. An examination of this washed sediment will often show hookworm eggs, when none could be found by repeated examinations of specimens prepared by the usual methods.

**The Written Instructions Posted in the Laboratory for the
Guidance of the Assistants in the Method of Collection
and Preparation of Specimens:**

Collection and Identification of Specimens.

1. Each person to be furnished with receptacle, and identification card marked with the name of the ship, date of arrival, and the alien's manifest number.
2. The persons are to be admitted to the closets one at a time, and will deliver the specimen to the attendant with the identification tag attached to the receptacle.
3. Upon receipt of the specimens the attendant will immediately deliver the same to the assistant, who will spray the specimen with a deodorizing agent.
4. The specimen receptacles will be thoroughly cleaned by the attendant after they have been discarded by the assistant.

Preparation of Microscopic Specimens.

1. About 2 grams of the fecal material will be thoroughly mixed with 5 cubic centimeters of 2 per cent aqueous solution of lysol, in a centrifuge tube.
2. The specimens are to be prepared as above in series of four, each centrifuge tube being marked by the proper manifest number.
3. The specimens will be centrifuged at high speed for one minute, the supernatant liquid will then be decanted and fresh lysol solution added and mixed with the sediment in the tubes. This operation to be repeated three (3) times.

4. Upon completion of the centrifugalization process, a small portion of the bottom sediment will be removed with a clean pipette and placed upon a clean slide, a small drop of aniline gentian-violet mixed with the sediment, and a clean cover glass placed upon it.

5. The receptacle containing the unprepared specimen, the centrifuge tubes, and the identification tags will be marked by the manifest number of the alien who furnished the specimen.

6. The slide preparations will be delivered at once to the medical examiner for microscopic examination, together with the identification tag.

The Identification of Specimens.

When a large number of examinations must be made during the course of a day, as is necessary in examining immigrants, it is advisable to adopt some method by which the source of any and all fecal specimens can be quickly and accurately traced, and which will surely prevent the occurrence of trouble arising from the confusing of specimens. The following method of keeping track of all specimens of feces obtained from arriving aliens at Honolulu has proved eminently satisfactory, and is recommended for its simplicity and unfailing accuracy: Each alien submitted for examination is furnished with a small shipping tag, upon one side of which is stamped the name of the vessel on which the alien arrived, the date of arrival, and the alien's manifest number. Every alien is required to attach his identification tag to the receptacle containing a specimen of his feces. No specimen of feces is accepted for examination unless this tag is attached to the receptacle when the specimen is delivered. This method makes it a simple matter to trace the specimens to their source, but it becomes necessary to carry the method of identification still further so as to avoid confusion when it comes to centrifugalizing four different specimens at the same time. This is accomplished in the following manner: When all the specimens have been properly tagged and delivered, the first four are placed together on the laboratory bench close to the centrifuge. The tags are now removed from the receptacles, and as each tag is removed the receptacle to which it was attached is marked with a blue pencil with the manifest number marked upon the tag.

As each sample of a specimen of feces is removed to a centrifuge tube the tube is also marked by a grease pencil with the

same manifest number previously marked upon the side of the receptacle from which the sample was taken. We now have the identification tag, the receptacle containing the unprepared feces, and the centrifuge tubes all marked with the manifest number of the aliens who furnished the specimens. This completes the method of identification for the first four specimens, and when the microscopic specimens are ready for examination they are delivered along with the proper identification tag to the examiner. It will thus be seen that the foregoing method can be applied in tracing any number of specimens without the slightest risk of causing confusion, and the examiner is enabled to refer back to any particular specimen if for any reason it is desired to re-examine it, as all unprepared specimens are retained until the examination of the entire batch is completed.

The Microscopic Examination of Slide Preparations.

A commissioned officer of the United States Public Health Service is detailed for this duty, and is held responsible for the efficient conduct of the work.

As the preparation of each series of four slide preparations is completed they are immediately delivered to the examiner along with the proper identification tag. The examiner now proceeds with the microscopic examination, using a Leitz low power objective 3, and a Leitz eyepiece 3, to search for the hook-worm eggs, as they can readily be seen with the low power, and the fields are much larger than when using the high power objectives, so that the examination proceeds rapidly. In beginning the search for the ova it is advisable to have some regular method of procedure by which the entire specimen is thoroughly gone over once as rapidly as can be done efficiently, rather than to proceed by moving the slide here and there in a haphazard manner, resulting in the examination of the same microscopic fields several times, and the consequent loss of time; and also very probably overlooking several eggs that would be brought to view by the use of a more systematic search.

The writer invariably begins the examination of all slide preparations in the extreme lower right-hand corner of the specimen, and moves straight across to the opposite lower left-

hand corner, then moving the slide down so as to bring the next field above into view, then straight back across the specimen to the same side at which the examination was commenced. This method of procedure is continued from one side to the other, renewing the field at each side until every part of the specimen has been searched, and no time has been lost in going over any part previously examined. Although the use of a mechanical stage in controlling the movement of the slide is of great assistance, it is not absolutely essential in making a systematic search of the specimen. Considerable skill is easily acquired in controlling the movement of the slide by the fingers. In the vast majority of cases the hookworm ova can readily be identified by using only the lower power objective, but occasionally it is desirable to inspect a doubtful specimen more minutely, and for this purpose the Leitz 6, or 1-12" oil-immersion, num. ap. 1. 30, is employed. During the progress of the examination it is customary to look also for the ova of other animal parasites, as a complete record is kept of the number of the different species found in the specimens, and their identification. The microscopic findings are briefly noted in pencil upon the front side of the identification tags, which serves as a preliminary record pending the completion of the entire number of examinations to be made, when the results are recorded in a book kept for this purpose.

The time required to collect, prepare, and examine the feces of arriving aliens is sometimes a matter of very great importance, as happens to be the case at Honolulu, owing to the limited facilities for housing and feeding any very large number of aliens at one time. This element in the examination of aliens has therefore received considerable attention with a view to reducing the time required for the medical inspection and at the same time maintaining a high degree of efficiency in the examinations. This has been accomplished by a close study of every step in the examinations, and the elimination of all unnecessary procedure. As stated elsewhere in this paper the time required to obtain about 50 specimens of feces from aliens will average about 30 minutes. This is believed to be the average minimum time required with the facilities available at the present time. The time consumed in the preparation and microscopic examination

of slide specimens, including the entire operation from the time receptacles are taken to the laboratory bench, to the completion of the microscopic examination, has been found to average 16 specimens per hour. At this rate from 96 to 112 microscopic examinations can be completed in one day.

The Further Examination and Treatment of Aliens Certified for Uncinariasis.

The evidence upon which a medical certificate is issued showing that an alien is affected with uncinariasis, is based solely upon the finding of the hookworm ova, or the worms themselves, in the feces. Uncinariasis is classed as a "dangerous contagious disease" in the Immigration Laws, and all aliens so afflicted are not permitted to land and reside in the United States territory. The United States Immigration authorities have authorized the treatment of certain aliens at the port of arrival, with a view to effecting a cure of the disease, and eventually permitting those cases to land in which a cure is effected, provided there are no other conditions so affecting the cases that would make their deportation mandatory. Upon receipt of a written request signed by the Inspector in Charge of the Immigration Service at Honolulu, the treatment of cases of uncinariasis in arriving aliens is conducted at the Immigration Station. Prior to beginning the treatment of any case of uncinariasis it is customary for the medical examiner to make a thorough physical examination of the alien with a view to determining his general physical condition, and whether or not any vital organ is so diseased as to make it inadvisable to proceed with the treatment. This preliminary examination also includes a study of the alien's blood, and special attention is given to the determination of the percentage of hæmoglobin, and red cells. The drug employed in the treatment of all cases is thymol, owing to its almost specific action in destroying the worms lodged in the intestines. The dose varies according to circumstances. In the treatment of adults in good physical condition, and without marked anemia, the full dose of 60 to 80 grains is given. In the treatment of children the dose is regulated according to the apparent age and physical condition. The full dose of thymol is divided into two or three

parts, each part being given at an interval of one or two hours apart. The patients are first given a dose of magnesium sulphate the evening before, and the following morning the first portion of thymol is administered in capsules loosely filled with the drug, no breakfast being allowed, and at the proper interval another portion is given, and so on, until the entire dose has been taken. Two hours after the last portion of the thymol has been taken a dose of magnesium sulphate is given, and unless the bowels are freely moved within four hours the dose of salts is repeated. While undergoing this treatment the patients are required to remain quiet and lie upon the right side, so as to facilitate the passage of the drug into the small intestines. Under no circumstances is castor oil ever given during the treatment of these cases, owing to the solubility of the drug in the oil. The drinking of milk, or anything containing alcohol is also prohibited. After the bowels have been moved several times following the last dose of thymol, a cup of tea without milk, and a little soup or broth is given. The allowance of tea and soup at this time has never been followed by any untoward symptoms, and it seems to stimulate and strengthen the patient, who by this time is considerably weakened by the lack of nourishment, and the action of the purgative. The question as to whether a cure has been effected as the result of the foregoing treatment is determined by microscopic examinations of the patient's feces made at frequent intervals for a number of days after the treatment. The finding of hookworm ova in the feces at one of the examinations is positive proof of living worms in the intestines, and is followed by a repetition of the treatment, until the feces are found to be free from hookworm ova after repeated examinations made at intervals after the last treatment.

The form used in taking histories and recording the results of examinations of uncinariasis cases prior to beginning treatment:

Clinical Data of Case of Uncinariasis.

Name..... Case No.....

OBJECTIVE SIGNS.

General Development..... Apparent age.....
 Hair
 Face..... Edema..... Expression.....
 Eyes..... Expression..... Pupils.....
 Neck..... Pulsation.....
 Skin and mucous membranes.....
 Chest..... Shape..... Muscular development.....
 Lungs
 Heart..... Position..... Sounds.....
 Abdomen..... Prominence.....
 Reflexes..... Pupil..... Knee.....
 Mentality

SUBJECTIVE SIGNS.

Headache..... Dizziness.....
 Palpitation..... Dyspnea.....
 Appetite..... Articles craved.....
 Epigastric tenderness.....
 Bowel movements..... Color.....
 Muscle power.....
 Menstruation

BLOOD.

Red cells..... White cells.....
 Hæmoglobin.....% ; Color index.....
 Polynuclear.....% ; Lge. Mononuclear.....% ; Lge. Lymphocyte.....%
 Sml. Lymphocyte.....% ; Eosinophile.....% ; Transitional.....%
 Mast cells.....% ; Abnormal cells.....

URINE.

Albumen..... Sugar..... Bile.....

A NOTE ON THE METHODS OF INVESTIGATING THE BIOLOGY OF SPIROCHÆTES.

By

H. B. FANTHAM, M. A. (Cantab.), D. Sc. (Lond.),
Liverpool School of Tropical Medicine.

Recently, February, 1915, Dr. S. B. Wolbach has published a note appended to a paper by him on "The Filterability and Biology of Spirochætes" in this *Journal*, Vol. II, No. 8, page 505. In this note he takes exception to a brief notice of certain of his results that I published in my paper on "The Granule Phase of Spirochætes" in the *Annals of Tropical Medicine and Parasitology*, December, 1914, Vol. VIII, page 478. I regret that he has misunderstood my remarks, which I trust the following observations will demonstrate. The subject is so important that any contribution to real knowledge of the same is most desirable, and it is indeed regrettable that misunderstanding should arise.

(1) Dr. Wolbach states: "Fantham's comments would lead one to believe that my conclusions regarding the multiplication of spirochætes in the epithelium of the Malpighian tubules of ticks were made from a single tick forty-seven days after feeding upon an infected rat."

How can this inference regarding a single tick be valid, when my opening statement is that "Wolbach (1914) sometimes found disintegrating spirochætes common in the gut cavity of ticks." Surely the use of the plural in the last word implies that more than one tick was used. Also, wherever Dr. Wolbach's work is referred to in my text, the plural, "ticks," is used. Dr. Wolbach used ten ticks. Perhaps he has misapplied my comment that "it has not been denied that spirochætes migrate through all the organs and tissues of the tick." Such observations have been made by several workers, including Wolbach and myself.

(2) My remark regarding the possibility of Dr. Wolbach overlooking the granule stages of spirochætes in the Malpighian epithelial cells of ticks is derived from his own statement, and is quite valid, whether one tick or ten ticks were employed. In

fact, unless the number of ticks and the number of days (forty-seven cited) were at least the same, and there was a dissection daily of at least one tick throughout the period, the results obtained could not be either conclusive or valid, and no generalisations could be made thereon. In order to avoid overlooking stages of a parasite which may occur on any day of the period, it is necessary to dissect at least one host on each day. My suggestion merely was intended to help progress in elucidating the life-cycle of spirochætes, by indicating a factor that had been overlooked.

(3) Regarding the time of fixation employed by Dr. Wolbach in his researches on spirochætes in ticks, namely, that "tissues may remain in the fixative [sublimite-alcohol] for several weeks without harm," he acknowledges that the method is not a cytological one. Hence, results obtained by the use of such a method naturally are open to objection. I fail to see that my comment could be construed into a "recommendation for cytological work."

Further, extravagant assertions as to the superiority of technique obtained by using sublimite-alcohol fixation followed by a slightly modified Giemsa staining of sections, obviously cannot be entertained. Many workers have been able to demonstrate spirochætes and their granules in sections of ticks by ordinary well-known cytological procedures, and have not relied merely on smears of organs, as Dr. Wolbach asserts.

Considering the futility of dogmatic assertions, which so frequently prove fallacious, and the waste of time involved in controversy, may I point out again that the furtherance of knowledge was the sole object of my remarks, and I trust that these aims may be achieved.

CORRESPONDENCE

La Romana, Republica Dom., April 20, 1915.

Journal of Trop. Med., New Orleans, La.

Gentlemen—I am very much interested in the report of Dr. Nathan Barlow in Cuyamel, Honduras ("Clinical Report of the Anti-Malarial Campaign at Cuyamel"), in your March issue.

If it is quite practical, I should like to test it out in a very difficult place here in Santo Domingo.

Could you inform me as to the following:

1. Is the idea of a ferment-action on the red cells quite settled, rather than quinin-action directly upon the plasmodia?
2. Why are we more successful when quinin is given just before the chill?

Very sincerely,

E. F. Otis.

New Orleans, May 6, 1915.

To the Editors—The campaign against malaria, by eliminating carriers, is quite practical, provided that all the inhabitants of the district are under the care of the same medical officers, and that there are no inhabited villages not under the same campaign, closer than the ordinary range of flight of anopheles.

In reply to Dr. Otis's first question, the idea is certainly not settled.

As to the doctor's second question, I do not believe that we are more successful when the quinin is given just before the chill, nor can I find any authoritative statement to that effect in any of the recent literature. I may add that I carefully studied this point from a clinical standpoint and was unable to see that there was any advantage in delaying the administration of quinin, so far as its curative effects are concerned. Aside from its action on the malarial parasites, quinin has a decided antipyretic effect, and if given just before a definite paroxysm might reduce the fever. On the other hand, many cases which are susceptible to the action of quinin are rendered exceedingly nervous, distressed and even delirious, if quinin is administered before or during the paroxysm.

It may be stated as a general rule, that if the therapeutic effects of quinin are in evidence before the parasites are one-quarter grown the following paroxysm will be premature, irregular and of less intensity, or possibly entirely averted. If the parasites are already one-half grown, the following paroxysm will not be altered, but the one succeeding that will be partially or entirely avoided.

Very truly,

N. Barlow.

AMERICAN SOCIETY OF TROPICAL MEDICINE.

Twelfth Annual Meeting, San Francisco, June 14, 15, 16, 1915.

Officers for 1914-1915.

President—Charles F. Craig, Fort Leavenworth, Kansas.

First Vice President—M. J. Rosenau, Boston.

Second Vice President—Bailey K. Ashford, San Juan, Porto Rico.

Secretary—John M. Swan, Rochester, New York.

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Councillors.

S. T. Darling, Ancon, Canal Zone.

Henry J. Nichols, San Francisco.

Victor G. Heiser, Manila, P. I.

PROGRAM (Preliminary).

First Day.

Monday, June 14, 10 A. M.

1. President's Address:

The Importance of Tropical Diseases to the American Practitioner, as Illustrated by Their Occurrence in the United States.

Charles F. Craig, Fort Leavenworth.

2. Treasurer's Report.

Joseph D. Weis, New Orleans.

3. The Exclusion of Tropical Diseases by Means of Immigration Inspections.

W. C. Billings, Washington.

4. The Control of Cholera on International Trade Routes, with Special Reference to Laboratory Methods for Detection of the Infection.

A. J. McLaughlin, Washington.

2 P. M.

5. Activities Looking to the Control of Malaria in the United States.

R. H. von Ezdorf, New Orleans.

6. Transmission of Malaria in the Philippine Islands.

Ernest L. Walker, Berkeley.

7. **A Few Cases of Black-water Fever; and of a Peculiar Entero-colitis.**
Elmer F. Otis, Romana, Dominican Republic.
8. **Sprue.**
Bailey K. Ashford, San Juan.

8 P. M.

Council Meeting.

Second Day.

Tuesday, June 15, 10 A. M.

9. **Secretary's Report.**
John M. Swan, Rochester.
10. **Modes of Transmission and Methods of Control of Plague.**
Rupert Blue, Washington.
11. **Experiences in the Treatment of Plague in the City of New Orleans.**
W. H. Seemann, New Orleans.
12. **Yellow Fever Control with Special Reference to Conditions at Iquitos, Peru.**
G. M. Converse, Washington.

2 P. M.

13. **Immunity of Filterable Viruses.**
Karl F. Meyer, Berkeley.
14. **S. Burt Wolbach, Boston.**
15. **Relative Merits of Anti-typhoid Vaccine.**
Henry J. Nichols, San Francisco.
16. **The Treatment of Typhoid Fever by Sensitized Vaccine Sediment.**
F. P. Gay, Berkeley.

8 P. M.

Public Meeting.

- The Influence of the Study of Tropical Disease on Medicine.**
Henry J. Nichols, San Francisco.
- The Accomplished Tasks of Tropical Medicine.**
John M. Swan, Rochester.

Third Day.

Wednesday, June 16, 10 A. M.

17. **The Present Status of Our Knowledge of Leprosy.**
G. W. McCoy, Washington.
18. **The Pajaroello Tick (*Ornithodoros coriaceus* Koch) with Special Reference to Life History and Biting Habits.**
W. B. Herms, Berkeley.
19. **Epizootic Lymphangitis and Sporotrichosis.**
Karl F. Meyer, Berkeley.

20. An Epidemiological Study of Poliomyelitis.*Wilbur A. Sawyer, Berkeley.***21. A Study of *Endameba buccalis* in Alveolodental Pyorrhea.***F. M. Johns, New Orleans.***22. The Relation of Pyorrhea Alveolaris to Tropical Dysentery in Man.***D. Rivas, Philadelphia.***23. Election of Officers, Etc.**

Notes.

Later details of meeting may be had from the Secretary, Dr. John M. Swan, 457 Park Avenue, Rochester, New York.

June 16 is to be the "American Society of Tropical Medicine Day" at the Exposition.

All of the scientific sessions and public meetings are open to the profession and to all interested.

NEWS AND COMMENT

Two cases of bubonic plague, with one death, were reported to the U. S. Public Health Service on April 10 from Havana.

Dr. Joseph H. White, surgeon, U. S. Public Health Service, has been promoted to the grade of senior surgeon in the Service.

All recruits in the Canadian army must be vaccinated against smallpox. Those refusing to comply with this order will not be accepted for service.

Dr. Allen W. Freeman, formerly Assistant State Health Commissioner of Virginia, has resigned to become epidemiologist for the U. S. Public Health Service, Washington, D. C.

Dr. Robert A. Herring, U. S. P. H. S., who has been stationed at New Orleans in connection with plague investigation there, will go to Tuscaloosa County, Alabama, to make a trachoma survey.

Dr. Samuel T. Darling, after ten years at Ancon, has undertaken service with the International Health Commission of the Rockefeller Foundation, and is to be located at Singapore (Government House), Straits Settlements.

The Academy of Medicine and other New York organizations have finally been successful in securing United States control of quarantine in New York. It is announced that the Public Health Service will soon take charge.

The annual meeting of the National Commission of Milk Standards was held in New York City May 8 to 9. The commission is composed of twenty health officers and sanitary experts of the United States and Canada.

There were 63 cases of beriberi present among the crew of the German cruiser *Kronprinz Wilhelm* which sought shelter in Hampton Roads, Virginia, on April 11, and 31 cases have developed on board subsequent to that time.

The mayor of Boston has asked for a sum of \$20,000 to enable Dr. Frank B. Mallory of the Boston City Hospital to devote his time entirely to research work. The attempt is being made to discover antitoxins for measles and scarlet fever.

Last year mill owners spent \$300 in oiling six and one-half miles of streams and ponds near Roanoke Rapids, North Carolina. The procedure proved so efficient in preventing the breeding of *Anopheles* mosquitoes and the consequent malaria, that similar measures will be taken this year.

A rat infected with chronic bubonic plague was found by the State horticulturist of Washington in the soil in a box containing plants from Yokohama, Japan. Though the box was opened in the appraiser's office upon arrival, it is not believed that the rat entered there, but instead came from Japan.

The first health conference of the Maryland Colored Health Association was held in Baltimore on March 25. The thorough enforcement of sanitary rules is proposed by the conference and also the education of the colored people along lines conforming to the sanitary standards of the white population.

Dr. Henry R. Carter, U. S. P. H. S., Baltimore, has been promoted by an act of Congress to the rank of Assistant Surgeon-General. Dr. Carter will direct the anti-mosquito crusade to be carried on in Baltimore. The promotion in rank is in recognition of Dr. Carter's part in the sanitation of the Canal Zone.

The national health office has been authorized by the President of Venezuela to establish stores where quinin will be sold at cost. The army, charitable institutions and wholesale and retail drugstores may also be supplied at cost. All inspection and dis-

tribution of the quinin is in charge of the Department of the Interior.

In order to preserve the popularity of York, Maine, as a summer resort, the inhabitants of the town have agreed that each shall be taxed one dollar and that the sum thus collected will be used for the salary of a full-time health officer. This step was taken to prevent a recurrence of the epidemic of typhoid occurring there last year.

The annual quarantine proclamation has been issued by the Governor of Texas, applying to all vessels, trains, persons and things coming from places infected with bubonic plague, cholera, yellow fever and smallpox. All places south of 25 degrees north latitude are considered infected unless satisfactory proof against such infection is furnished.

Prof Friedrich Loeffler died recently in Berlin at the age of 63. Prof. Loeffler was the discoverer of the bacillus of glanders and of the diphtheria bacillus. He was associated in the founding of the *Centralblatt für Bakteriologie*, was professor of hygiene at Greifswald and has recently been the director of the Institute of Infectious Diseases in Berlin.

A short course for health officers was given in Lawrence and Rosedale, Kansas, from April 19 to May 1. Surgeon Mark J. White, U. S. P. H. S., St. Louis; Dr. John S. Fulton, Baltimore, secretary of the Maryland State Board of Health, and Dr. Albert J. Chesley, Minneapolis, epidemiologist of the Minnesota State Board of Health, were in charge of the course.

A prize of \$1,000 has been offered by the Metropolitan Life Insurance Company through the American Social Hygiene Association for the best essay on social hygiene for adolescents between the ages of 12 and 16 years. The contest closes July 31, 1915. Any inquiries may be made of the American Social Hygiene Association, Inc., 105 West Fortieth Street, New York City.

The first part of March there were 12,000 soldiers in Serbia with epidemic diseases, 4,157 having typhus. Of the 550 physicians in Serbia at the beginning of the war, 65 have died, 43 from typhus. Twenty-three physicians from other countries are also said to have died in Serbia from contagious diseases. It is reported that already there have been 50,000 deaths from typhus.

The probable influx of immigrants at the close of the war will necessitate the closest watch being kept on all ports of entry in order to prevent the entrance of any of the communicable diseases now prevalent in Europe. Toward this end, the United States Government, through the Public Health Service, is planning to take over the control of the quarantine stations at New York, Boston, Baltimore, Galveston, etc.

After a meeting of the College of Physicians of Philadelphia recently, a symposium on National Hygiene was held. "The Organization and Activities of the International Health Commission" was the title of a paper read by Dr. John A. Ferrell, assistant director-general of the Rockefeller Foundation. Dr. Joseph S. Neff read a paper on "The Recent Health Movements in the United States, with Special Reference to Infant Welfare Work."

The following have been appointed members of the Chinese Medical Board of the Rockefeller Foundation: John D. Rockefeller, Jr., chairman; Wallace Buttrick, director; Frank J. Goodnow, Harry Pratt Judson, Dr. Simon Flexner, Dr. William H. Welch, Jerome D. Greene, John R. Mott, Wickliffe Rose, Starr J. Murphy, Frederick T. Gates, and Dr. Francis W. Peabody, with E. C. Sage as secretary and Roger S. Greene resident director in Peking.

"Typhoid Mary" has caused another epidemic of typhoid fever. After being kept for three years virtually a prisoner on North Brother Island, New York, she was released with the understanding that she should not serve as a cook. She did not hold to this understanding, however, and has hired out as cook

five times, under as many aliases, the last time being at Sloane Maternity, where she was the cause of twenty-five cases of typhoid(two of which ended fatally, before she was discovered.

The trustees of the Rockefeller Foundation have asked Surgeon General W. C. Gorgas to become a permanent member of their staff in the capacity of adviser in public health, sanitation and epidemics. If General Gorgas accepts, he will probably be sent to Serbia to be placed at the head of the work being done there by this country. If the invitation to become a member of the Foundation is accepted, it will be necessary for General Gorgas to retire from the army and if he goes to Serbia he may be required to resign from the army entirely.

A series of lectures on "The Medical and Social Aspects of Hygiene" were given at the New Orleans Normal School, from March 26 to May 28. They included: "Prevention of Malaria," by Dr. C. C. Bass; "Physical Health and Juvenile Delinquency," by Judge A. H. Wilson; "Oral Hygiene," by Dr. J. A. Gorman; "Nutrition in Infancy and Childhood," by Dr. Dandridge P. West; "Hygiene of the Skin," by Dr. Isadore Dyer; "Hygiene of the Eye," by Dr. Marcus Feingold; "Significance of Physical Measurements of Children," by Dr. Chas. J. Bloom; "Nervous and Mental Hygiene," by Dr. E. M. Hummel, and "How Teachers May Help the Medical Inspector," by Dr. Edmund Moss.

Sir George Turner died recently in England at the age of 79. For many years Dr. Turner has been in public health work both in England and Africa, being sanitary adviser to the army during the South African war and later health officer of the Transvaal. Much of his time was devoted to the bacteriologic study of leprosy, which he continued in England even after his retirement from his other activities. By accident he one day discovered marks on his hands which told him at once that he had been attacked by the fatal disease. He, however, still continued his researches on the disease from which he was suffering. After his affliction, he was knighted by the King.

A party of physicians has sailed from New York for Naples to join Dr. Richard P. Strong for health work in Serbia in connection with typhus. They include: Dr. Thomas Wright Jackson, chief sanitary inspector; Drs. Andrew W. Sellards, George C. Shattuck and Francis B. Grinnell, of Harvard; Drs. Hans Zinsser and Eugene W. Caldwell, of New York; and Luis de la Pena and W. S. Standifer. The two latter have recently been working in the Canal Zone on diseases caused by insects and were members of General Gorgas' staff in the sanitary work on the Isthmus of Panama. These physicians and Dr. Strong compose the American Red Cross Sanitary Commission. The members of this commission, which will combat typhus, cholera and other diseases threatening the people of Serbia and Austria, were selected by the American Red Cross Society. The project is financed by the former society and the Rockefeller Foundation, each having furnished \$25,000. The Serbian Relief Commission is helping to raise additional funds. Already over \$30,000 worth of supplies have been sent Dr. Strong at Saloniki, Greece. England and France are also co-operating with this country and an executive committee composed of Dr. Strong, Sir Ralph Paget and Dr. Joubert, of Paris, has been formed.

Public Health Activity.

CALIFORNIA.—*Bulletin of the State Board of Health*, March, 1915. The danger and harm that may result from disregarding quarantine is shown here. A little girl living in a lighthouse on an island in the Pacific Ocean and attending school in a small town on San Francisco Bay, contracted diphtheria during an epidemic at the school. She was quarantined at the home of relatives in the town, where she remained for two weeks. One negative culture was obtained. The child was very anxious to be home in time for the Christmas holidays and was finally allowed to go. Within a week, the younger brother, who had not been away from the island, was taken to San Francisco with the disease and died there. Examination of the other inhabitants of the island—about thirteen—showed that two had become diphtheria carriers and organisms contained in the throat of a third were suspicious.

ILLINOIS.—*The Institution Quarterly*, March 31, 1915. Four years ago the Safety First movement was organized on the Chicago and Northwestern Railway by Mr. Ralph C. Richards, who in this bulletin gives an interesting article on the necessity for and meaning and success of this now country-wide movement. Not only has it spread over this entire country on the railroads and in shops, factories, etc., but it has been taken up by Japan and Great Britain. Mr. Richards gives a few figures that illustrate graphically the success of the movement. In the forty-seven months that the organization had been in existence when the article was written, there had been the following reduction in deaths and injuries: 137 fewer employees killed; 8,882 fewer employees injured; 837 fewer passengers injured; 174 fewer outsiders killed, and 172 fewer outsiders injured. Since the majority of those killed are husbands and fathers and therefore bread-winners, the poverty and sorrow resulting from these deaths is enormous. The prevention of this and the wonderful saving of life itself are factors that should commend the movement to every man, woman and child in this country.

INDIANA.—*Monthly Bulletin of the State Board of Health*, January, 1915. The county superintendent of Blackford County, Indiana, has gotten together a few figures showing the actual loss in money through the absence of children from school. All expenses, such as teacher's salary, janitor service, heating, etc., must continue so long as there are any children left in school. Taking the cost of operation in four townships for one month and figuring the percent of attendance, the loss was found to be \$245.61. From these figures it is easy to see that there is also a monetary side to the prevention of sickness and epidemics among school children. If the loss was \$245.61 in four townships where the attendance was comparatively high, what must it be in an entire State where epidemics of measles, whooping cough, diphtheria or smallpox are frequent and sometimes necessitate the closing of entire schools?

MICHIGAN.—*Public Health*, March, 1915. Dr. Victor C. Vaughan contributes an article on "Crime and Disease" (first

printed in *Journal of Criminal Law and Criminology*.) It is this eminent physician's opinion that with the perfection of public health and sanitary measures will come the diminution of crime. Heredity may be a causative factor in the making of criminals, but the greatest trouble lies in environment and companionship. Through constant and rigid inspection and supervision of all premises and especially of the likely breeding places of criminals, through segregation of defectives, through the prevention of reproduction by these defectives, through medical inspection of every individual and continued education, will come the final eradication of much disease and crime.

NEW YORK.—*Weekly Bulletin of the Department of Health of New York City*, April 10, 1915. A wave of the magic wand of the Department of Health, and the miracle has come to pass. For surely an uncrowded car during the rush hours in New York is nothing less than a miracle. Most New Yorkers have probably had a hope deep in their heart that some day there would be seats for all, but the hope has been a faint one and they have gone on submitting to what they felt they could not help. Commenting on this submissiveness, the *Evening Mail* says that the average New Yorker is "a stand-patter, even on his inconveniences. He really wants to be a cross between a sheep and a sardine. He wants to be crowded, packed and driven. At least, so we are told. But this statement may be greatly exaggerated—and, anyway, when the New Yorker gets used to an improvement he generally likes it. It is worth while to try one on him once in a while." And the Department of Health is trying one on him that ought to add materially to his happiness as well as his health.

CURRENT LITERATURE

TROPICAL ULCER (KLINISCHE WAARNEMINGEN OMTRENT HET ULCUS TROPICUM).—J. C. J. C. Smits (*Geneeskundig Tijdschrift voor Nederlandsch-Indie*, 1914, LIV., page 674), has studied 241 cases of tropical ulcer both clinically and microscopically. The cause of the disease the author finds to be due to the symbiosis of fusiform bacilli and the spirochete of Vincent. The patient acquires the disease, he believes, by working barefooted in the thin mud of plantation drains. The cases are most numerous during the months with the largest rainfall. It is improbable that the organisms penetrate the sound skin; there must be some kind of an abrasion. Tropical ulcer is a distinct disease from hospital gangrene. Tropical ulcer frequently co-exists with syphilis and yaws. In these cases the Wassermann test is not of sufficient practical use to make a diagnosis. In uncomplicated tropical ulcer the author has obtained striking benefit with the use of hydrogen peroxide. Complicated cases must be treated by cleaning of the wound and stimulating the vitality of the tissues; sometimes plastic operations are necessary; sometimes he uses a saturated solution of picric acid as a dressing and sometimes a 10% amidiozotoluollanolin. In some case salvarsan injections have been of benefit, even when the ulcers were not complicated by syphilis and yaws. *John M. Swan.*

TUBERCULOSIS IN KAISER WILHELMS LAND (GERMAN NEW GUINEA). (*Die Tuberkulose in Kaiser-Wilhelms-Land* (Deutsch-Neuguinea.) (H. E. Kersten, *Archiv für Schiffs-und Tropen-Hygiene*, Bd. 19, Heft 4, 1915.) The cutaneous reaction of v. Pirquet modified by Peiper was carried out in numerous patients in the various villages and hospitals of the possession, with results as summed up by the author, who concludes: that tuberculosis has not become universal, but seems likely to be following in the path of civilization; that Peiper's modified v. Pirquet reaction is of value in the tests; that it is necessary to increase the protective measures. *L. C. Scott.*

MEDICAL SCIENCE OF THE CHINESE. (*Aus der Arztlichen Wissenschaft der Chinesen.*) (H. Vortisch-van Vloten, *Ibid.*) The description of the primitive methods in vogue among the Chinese doctors for diagnosing disabilities of the human organism by noting variation in pulse and the agencies which may influence it, are doubtless interesting, but belong rather to the pages of an anthropological publication than to a journal of tropical medicine and hygiene. L. C. S.

SARCOPHAGA FUSCICAUDA BOTTCHER, AN INTESTINAL PARASITE OF MAN. (*Sarcophaga fuscicauda Böttcher, ein Darmparasit des Menschen.*) (Adolf Eysell, *Archiv für Schiffs-und Tropen-Hygiene*, Bd. 19, Heft 1, 1915.) The article is a description of larvæ and of adults obtained from the larvæ of the fly. These larvæ were obtained from the feces of a Chinese sailor by Marine Staff Surgeon Prof. Hoffman in 1913. The sailor came from the hot zones of South China and was interned in the Garrison hospital of Tsingtau on account of a severe intestinal catarrh. As many as fifty larvæ were found in each stool during a period of eight days. Santonin and calomel cured the case. L. C. S.

THE SPOROLOGY OF HÆMOPROTEUS COLUMBÆ.—(Helen Adie, *The Indian Journal of Medical Research*, Vol. 2, No. 3, January, 1915.) Observations were made on the fly, *Ambala Lynchia*, between the middle of June and the end of September. The oökinete, the zygote, the oöcysts and sporozoites in the salivary glands were found. The description of the salivary organs presents some interesting points, especially the accessory "goblet shaped organ" along the excretory ducts which unite to form a single one. The disease could be transmitted from infected pigeons to young flies bred in the laboratory, in which the zygotes and sporozoites eventually were formed. L. C. S.

OBSERVATIONS ON THE RESPIRATION OF THE CULICIDÆ.—S. K. Sen, *Ibid.*) The average rate of oxygen consumption varies for different species and measured according to the neat apparatus devised, varies between 1.1 c. m. m. to 25 c. m. m. per hour. The writer found no evidence of nitrogen absorption by pupæ. *Culex* was found to be more susceptible to lack of oxygen than *Stegomyia*, and especially the larvæ. Trials of vapors of

various oils proved that their presence led to the death of the larvæ without excluding the oxygen; that is, they exerted a toxic action.

L. C. S.

THE DANGERS OF CARRIERS AND CHRONIC ELIMINATORS OF BACILLI ON BOARD SHIP. (*Die Gefahr der Bazillenträger und Dauerausscheider an Bord.*)—(A. E. Pannenberg, Bremerhaven, *Archiv für Schiffs-und Tropen-Hygiene*, Bd. 19, Heft 1, 1915.) The writer, after a considerable amount of preliminary observation regarding typhoid and cholera carriers on land and on sea in past years and the rôle they play in the dissemination of the two diseases, draws attention to the conditions confronting the ship's doctor on the great transatlantic steamships now plying between the various ports of the world. Considering the manifold duties of the numerous personnel, it appears to be very remarkable that epidemics of ship scourges are not more prevalent. This the author considers as due (which beyond a doubt it is not) as much to the cleanliness of the ship as to the sanitary conditions. The article treats of the hygiene and prevention of the contagious diseases, presents nothing particularly novel, and is of special interest to the marine physician only.

L. C. S.

TERTIAN MALARIA RELAPSES FOLLOWING IMMEDIATELY UPON TREATMENT WITH SALVARSAN. (*Malaria tertiana-Rückfälle unmittelbar nach energischer Salvarsanbehandlung.*) (*Archiv für Schiffs-und Tropen-Hygiene*, Bd. 19, Heft 4, February, 1915.) Staff Surgeon Summa, Chief Surgeon of the Garrison Hospital in Windhuk, presents a number of interesting cases coming under his and a colleague's observation respecting the relapse of the quinin resistant tertian after treatment with salvarsan. These cases received 3.2 grams, or six injections of salvarsan. The result was a complete disappearance of the parasites from the blood. In the several cases it was found that the localities subsequently visited by the patients were malaria free, yet after varying periods new attacks of malaria, with accompanying ring and gamete forms in the blood, occurred. It was therefore the conclusion that the salvarsan was not completely effective in eradicating the disease, inasmuch as the gamete forms do not occur in any but long-standing untreated, or incompletely treated cases.

L. C. S.

BACILLARY DYSENTERY.—(H. S. Gettings, *Transactions of the Society of Tropical Medicine and Hygiene*, Vol. VIII, No. 4, February, 1915.) The social and sanitary conditions of the middle ages were parallel with those prevailing among the lower and poorer classes of the Orient. This presents a suitable "soil" for the transmission of the scourges of mankind, among which dysentery played such havoc among the poverty stricken of medieval England. Raise the sanitary and economic conditions, and dysentery ceases. Teach cleanliness and adherence to hygienic rules, and the disease will disappear. The decimation of the armies by dysentery was a problem always to be reckoned with. The advantage of the trained over the raw recruits nowhere is more demonstrable than in the ability of the former to ward off the ravages of the disease. Warm clothes, dry housing and observance of simple sanitary precautions suffice, to a great extent, to prevent the spread. The Grand Army of Napoleon owed its defeat in the invasion of Russia in 1812 not a little to dysentery. The armies of the Crimean Wars, the Franco-Prussian troops, those of the Danish War, all suffered from dysentery. The writer finally considers the conditions of the troops in the present war and contrasts the treatment with that of previous campaigns. The article is concluded with a series of histories of London epidemics and statistics, the English asylums, the conditions prevailing in the army during peace times. The bacteriology, sources of infection and lastly the prophylactic measures to be adopted are considered briefly. There follows a discussion of the paper by Dr. Sandwich, giving interesting data concerning the prevalence at the present time on the continent; by Dr. W. J. Simpson, relative to conditions during the Boer War; Dr. D. R. Robert, with experiences in the French Red Cross Hospital in Northern France; Dr. Low and the President, Sir R. Havelock Charles.

L. C. S.

PREVENTION OF BERI-BERI AMONG THE PHILIPPINE SCOUTS BY MEANS OF MODIFICATIONS IN THE DIET.—(Weston P. Chamberlain, *Journal of the American Medical Association*, April 10, 1915, Vol. LXIV, No. 15.) It has been found that the epidemicity of beri-beri among the enlisted native scouts of the various garrisons in all parts of the archipelago varied with the

diet; that especially the polished rice could be made responsible, as brought out during the researches of Braddon, Stanton, and Fraser, and others. It was accordingly taken up by the Army Board, with the result that partial substitution of the rice by beans was advised and became compulsory. The result was the eventual eradication of the disease. Finally the polished rice was supplanted by under-milled rice. Six cases only are reported since 1910, in which year there were 50, though this figure in itself represents a great decrease in the number even of the previous year, which according to Table I was 558. Among the American troops, twelve admissions to hospitals were made between the years 1904 and 1913. However, since the consumption of alcoholic stimulants in considerable quantities is very prevalent among the white troops, the writer thinks it quite possible that some cases may have been alcoholic peripheral neuritis. Among the negro troops there have been no cases since 1910. It has been pointed out by various investigators that prepared starchy foods, such as macaroni, wheat flour, wheat bread, ship biscuit, sago and hominy have caused polyneuritis gallinarum. Moreover, the superheating that occurs in the sterilization of preserved goods leads to the destruction of the neuro-protecting substance, the vitamine. This, the author thinks, may explain away the credence given the infection theory, especially since Lovelace appears to have defended it on the grounds of his experience in South America. The conclusion—and the statistics certainly support it—is that beri-beri is due to the lack or insufficiency of some substance in the dietary. L. C. S.

MYIASIS OF THE URINARY PASSAGES.—E. F. King, Washington, D. C. (*Journal American Medical Association*, December 26, 1914), reports a case of myiasis of the urethra in which the patient discharged the larvæ of *Fannia scalaris*, a small fly commonly found about latrines and known as the latrine fly. The contamination probably took place during a long sitting at the stool, the fly probably being attracted by the presence of a slight urethral discharge. This is the eighth case so far reported of myiasis of the urinary passages.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

Brief Account of the Work Performed by the Institute of Tropical Medicine and Hygiene (Porto Rico) from April 1st, 1914, to December 31, 1914.

The Associated Out-Patient Clinics of the City of New York. Second Annual Report, 1914.

Transactions of the Society of Tropical Medicine and Hygiene. March, 1915, Vol. VIII, No. 5.

BOOKS.

THE PRINCIPLES OF HYGIENE. By D. H. Bergey. Fifth edition, thoroughly revised. Philadelphia: W. B. Saunders Company, 1914.

The new edition of Prof. Bergey's well-known manual of hygiene presents in its contents a clear, practical and concise outline of all the essentials of the subject. As a text-book for undergraduates it approaches as near to the ideal as could be desired. The volume contains twenty chapters, in which all matters of importance pertaining to the individual and public health are briefly but amply treated, considering the vastness of the accumulated hygienic data. As a handy reference book for practitioners, it would undoubtedly prove of great utility, but it appears to be best adapted to the uses of the undergraduate medical student. The size and compactness of this edition must be further qualifications highly recommending the excellent work to the student, the teacher and the practical man.

L. C. Scott.

THE ELEMENTS OF MILITARY HYGIENE By P. M. Ashburn, M. C., U. S. A. Second edition. Houghton Mifflin Company: Boston and New York. Price \$1.50.

The author very properly justifies the appearance of a new edition of this work by the increasing interest in the subjects discussed, and this is particularly true at a time when so many younger men are ready to enter service in the field, where the principles of military hygiene apply. The text is arranged for easy digestion and is put plainly for practical use in the training of the medical man for military practice in hygiene. The examination of the recruit, the questions of personal hygiene, food and dietaries, community hygiene in barracks and camps, as well as for moving troops, conditions of climate, predisposing causes of disease, infections and their prevention, and venereal diseases, are all comprehensively covered, notwithstanding the fact that all the matter is covered in some 340 pages, in a book of handy size. The material is brought up to the moment and altogether satisfies a present need in a ready, readable, guide to military hygiene.

Dyer.

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MANAGING EDITORS

CHARLES CHASSAIGNAC, M. D.

ISADORE DYER, M. D.



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VOL. II.

JUNE, 1915

No. 12.

EDITORIAL

The Present Status of the Prevention of Malaria.—The common illustration of the swinging of the pendulum from one extreme to the other and finally settling down on the more stable middle ground is perhaps no more applicable than to the prophylaxis of malaria. Before the epochal discovery of Ross, the only effective prophylaxis was the use of quinin and avoidance of the bad air chiefly of the lowlands, which we now know to have depended for their influence upon the anopheles usually associated with it. The discovery and complete proof of the mosquito transmission of malaria, as might have been expected, was followed by a period during which prevention of mosquitoes or protection against their biting patients or susceptible persons were given the most consideration, while the importance of quinin prophylaxis was neglected to a great extent. In a recent bulletin (Bulletin No. 6, Medical Department, U. S. Army, on "The Prophylaxis of Malaria with Special Reference to the Military Service") Captain Charles F. Craig directs attention

to the great reduction in malaria in the army since 1898, which has resulted chiefly from measures directed against the mosquitoes that transmit the disease and the protection of the soldiers from the bites of these insects. Craig recognizes the neglect of quinin prophylaxis in the following paragraph:

“The decrease of malaria in the Army has been brought about largely by measures directed against the mosquitoes transmitting the disease, and the protection of man from the bites of these insects. Quinin prophylaxis has probably had but little to do with this reduction, as the use of this method has been very limited. Neither has the control of treatment by microscopic examinations of the blood and the treatment of ‘carriers’ and latent infections operated to any extent in reducing the disease in the Army, as these methods have been very little used, and it is believed that had these methods been widely employed the reduction of malaria would have been much more marked and much more rapid than it has been.”

What a great power for good is lost whenever quinin prophylaxis is neglected is shown by the results where this measure only has been employed. A great reduction in the amount of malaria among the farming people of Italy during the few years since the free distribution of quinin to the poor and the sale of it at cost by the Government was inaugurated in 1902. Celli states that the number of cases of malaria treated from Agro Romano, a very malarious district outside of Rome, in 1900 was 11,653, while during the last five years ending in 1911 the average number was 2,974. It must be noted that the offering of quinin is only a part of quinin prophylaxis. The actual benefit is determined by the extent to which it is used. It has been generally observed that people can be induced to carry out prophylactic measures rather extensively whenever malaria is bad, and very little whenever it is mild. In a recent publication (Reprint No. 175 from the U. S. Public Health Reports) Carter cites the case of a penal agricultural colony at Castiadas, where the quinin was given under orders. “The cases of malaria in 1904, 1905 and 1906, when no quinin was given for prophylaxis,

were 76 per cent of the force. In 1911—after four years use—there were 5 per cent—less than one-fifteenth as many.”

Another important factor in the prevention of malaria has received a certain amount of the attention deserved. We refer to malaria carriers and more thorough treatment of malaria patients. In the United States, especially, there has been conducted a considerable but unorganized educational campaign among the medical profession and medical schools by writers upon malaria and teachers in medical schools. Attention has been repeatedly called to the fact that a malaria patient, if discharged without further treatment, as soon as active symptoms cease, usually remains a malaria carrier for months thereafter; therefore treatment should be continued until there are no gametes present in his blood. More thorough treatment is being advocated and is being put into effect. Already the effect is being felt and the reduction in the prevalence of malaria in most parts of the United States is very noticeable. Were it not for the fact that the reduction finally leads to carelessness and neglect, we could confidently hope to see malaria gradually but surely disappear from most parts of this country. One thing is lacking and that is to make malaria a notifiable disease and to place certain restrictions around malaria carriers until they cease to be a menace to the health of others.

It can be stated in summary that the most ardent supporters of what may be called mosquito prophylaxis of malaria are recognizing the importance of quinin prophylaxis and what may be called carrier prophylaxis, while those who have urged quinin prophylaxis to the neglect of anti-mosquito measures recognize the necessity for a combination of all available means if the best results are to be obtained. Different localities lend themselves better to one measure than to another, but the tendency is to employ all measures as much as possible rather than one only.

C. C. Bass.

ORIGINAL ARTICLES

MOSQUITO ERADICATION AND PREVENTION.

With Special Reference to the Malaria-bearing or *Anopheles* Mosquito.

By

WM. D. WRIGHTSON,
Sanitary Engineer.
New Orleans, La.

Introduction.

With the advent of spring the problem of eradicating the mosquito presents itself to the minds of cities, counties, and states, and it is with the view of suggesting a few remedies to those interested in this problem, that this paper is written.

Malaria.

Malaria is one of the most prevalent of all preventable diseases, its greatest field being the Tropics, but it is found to a large extent in the North Temperate Zone.

Transmission.

It is transmitted by the bite of the female *Anopheles* mosquito, the cycle being from man to mosquito to man.

Habitations.

The *Anopheles* may be said to be a sylvan mosquito. Except under artificial conditions few are found to breed in containers, but are invariably found in shaded pools, pockets along the edges of streams and ditches, amongst driftwood, in old wells, in hoofprints of cattle, in palm trees and other plants of similar construction, and in fact wherever water and vegetation are present and in conjunction. It appears that vegetable matter, particularly algæ, forms the principal food supply of the larvæ of this pest.

Peculiarities and Marks of Distinction.

The larvæ of *Anopheles* are readily distinguished from those of *Stegomyia* and *Culex*, in that they may be said to rest parallel

with the surface of the water, while *Stegomyia* and *Culex* rest with their heads down, being supported by their breathing tubes. In the adult mosquito the *Anopheles* is again easily distinguished. It may be said to rest and feed with its body parts at an angle with the surface upon which it is resting, while the *Stegomyia* and *Culex* may be said to rest and feed in a hunchbacked position.

During the day *Anopheles* remain hidden in grass, bushes, under tables, desks, chairs, in closets behind clothing, and in fact wherever it is dark and they are free from molestation. As twilight comes on they will be seen out in the open and upon screens trying to get into the house. From then on until the early hours of the morning they bite promiscuously. As daylight appears they will again be observed upon the screens trying to get out in the open to a place of safety. It is a rare thing to be bitten by an *Anopheles* during the day out in the sunlight.

Procedure in Locating Breeding Places.

When an inspector approaches a premise for the purpose of making a mosquito inspection the following methods are generally used: First, he carefully notes the character of the house, its appearance from a sanitary point of view, and the possibility of the inhabitants being careless in the matter of leaving rubbish about and water standing in tubs, barrels, etc. Arriving at the house he carefully inspects all such bottles, cans, tubs, barrels, flower pots, hoofprints, wagon tracks, and all water containers for larvæ, noting at the same time the presence of any adult mosquitoes. Having satisfied himself of the conditions immediately surrounding the house, he then moves further away, gradually increasing his circle of inspection about the house. At a point, say about one hundred feet from the house, he comes to tall grass and bushes. He plunges into this, kicking the grass to right and left and shaking the bushes in order to disturb any hiding adult mosquitoes. Arriving at a small pool or pond carefully hidden away amidst such surroundings, he carefully notes the conditions in and about such pool—if there be vegetable matter present in the water or grass or other substance which might shelter larvæ. Again, satisfying himself upon these points, he takes his dipper (generally a white porce-

lain saucer) and dips off the surface of the water with a rapid movement, in order to catch the larvæ before they become alarmed and sink to the bottom. *Anopheles* larvæ are very easily alarmed and at the approach of anyone immediately dart to the bottom of the container or pool, where they remain for a considerable period of time. Finding no larvæ or egg floats, the inspector next stirs up the bottom of the pool with his foot or a stick, thereby making the water muddy, carefully watching as it clears for the presence of larvæ. Noting the presence of larvæ and its species he proceeds with his inspection until he has completed a circle of about 100 yards in diameter. He then returns to the house and questions the inhabitants about the prevalence of mosquitoes and points out to them where he has found larvæ, the species, what disease it conveys, and suggests remedies for their eradication. If invited to make a house inspection he proceeds as follows: First going to the bedrooms, he opens the closets and peers into all dark corners, shaking the clothing to disturb any hiding mosquitoes; then to the dark corners of the room, looks under mantelpieces, under chairs and beds, behind furniture, and on the ceilings and walls. Not finding mosquitoes in the bedrooms or sitting room, or in those parts of the house where the family are accustomed to spend most of their time, it is almost safe to conclude there are no mosquitoes in the house, but the inspection should be carried out in every room. Should he find adult mosquitoes present and of different species he should show them to the family and explain in more or less detail the class of mosquito, its distinguishing marks, where found, the disease it conveys, and how to eliminate their breeding places. He should also explain to them how mosquitoes in the house will go to the screens in the early hours of the morning in order to get to a place of safety, and how they may best be caught at this time with a small tube, containing a very small amount of chloroform, or kerosene, which is placed over the mosquito as he rests on the screen. To catch them on the ceiling, small cans partially filled with kerosene and fastened to a broom handle, held directly under them until the fumes of the oil cause them to drop into the can, is the best method.

Prevention.

Under this heading will be discussed the following methods: Quinin prophylactic, screening, control of carriers in camps, clearing of vegetation, oiling, filling, and draining.

Quinin Prophylactic.

This method consists in the administration of quinin in small doses for a period of several months during the so-called "malarial season," or all year round in those localities where malaria is prevalent and the climate warm, for the purposes of control and prevention of malarial fever. The quantities and methods of administration are essentially subjects for the physician and are very ably described in Public Health Reports, Vol. 29, No. 13, March, 1914, and Bulletin No. 6, Medical Department, War Department.

Screening.

All houses in a locality where mosquitoes and flies are plentiful and malaria prevalent should be properly screened. Not only as a means of precaution against fever, but for convenience and comfort. The best material for house screening is No. 18 mesh copper wire. A house should be screened in the following manner: The bottom panel of all doors should be reinforced with boards or laths, and two or three such laths should be placed at the bottom of the top panel to protect the screening from tearing in opening and closing the door. All doors should open outward, and should be provided with a strong spring in order that they may be at all times closed tight. It is advisable to tack strips of canvas on the edges of the door to prevent the ingress of mosquitoes between the door and the frame. Window screens should never be of the common telescope variety, but rather consist of a single piece of screening nailed to the window frame between the window and the shutters. Fireplaces, chimneys, drainpipe holes, and all other such openings through the floor or walls should be screened. A very thorough and complete method of screening the house is that suggested by Dr. R. H. Von Ezdorf, and published in Public Health Reports, Vol. 29, No. 9, February 27, 1914.

Control of Carriers in Camp.

By the term "carrier" is meant those people who have had malarial fever and have been improperly treated, or those who have the malaria germ in their systems but have experienced no active symptoms. It is the danger from these people being at large and moving about from place to place, infecting *Anopheles* mosquitoes with the germ, which we must govern. Such carriers should be placed in screened hospitals under mosquito bars, where there is no possible chance of their infecting mosquitoes, and given quinin treatment until they are cured or all danger from infecting mosquitoes eliminated. All buildings in which such carriers have lived should be fumigated before being used again and all screening should be carefully gone over to see that there are no holes or defects in the screening through which mosquitoes might enter the building. In all buildings to be used as quarters or barracks there should be installed traps in the windows and under the eaves, and there should be a daily hand catch of all mosquitoes within such buildings. All temporary construction camps should be screened, the occupants placed under mosquito bars, and trapping and hand catching carried on daily, in order that the men remain in good health, thereby rendering more efficient work. The best time for hand catching in quarters is between the hours of 4 and 7 p. m., when mosquitoes will be seen coming into the building, and between 5 and 9 a. m., when they will again be seen leaving the building. I think I may safely say that, by the free and liberal use of quinin in Panama and Vera Cruz, many common carriers were cured, and thus prevented from introducing malaria fever yards about settlements, not only to prevent shelter for adult into many parts of the United States. Another feature which should receive the attention of all interested in malaria prevention measures is a shifting of the population from one community to another. This is especially noticeable in the Southern States when a new enterprise opens and there is a call for labor. Many persons will leave a malaria-infected region and move to these new localities, bringing along with them the malaria germs in their blood, and, if there be *Anopheles* present, infecting them, and in a short time spreading malaria throughout the community.

Clearing of Vegetation.

All vegetation should be cut close to the ground within 500 mosquitoes, but to disclose all small breeding areas, such as pools, tin cans, bottles, hoofprints of cattle, and other water containers. On the Canal Zone the area cleared was within 200 yards of all settlements and it was noticeable that after such clearing was made there was a marked decrease of adult mosquitoes. I would suggest that where possible this cleared area be extended to within 500 yards of dwellings for the same reasons as given above: i. e., less shelter for adult mosquitoes, and the disclosure of more breeding places. All grass and bushes within such cleared area should be kept short at all times, and especially during the rainy season.

Filling.

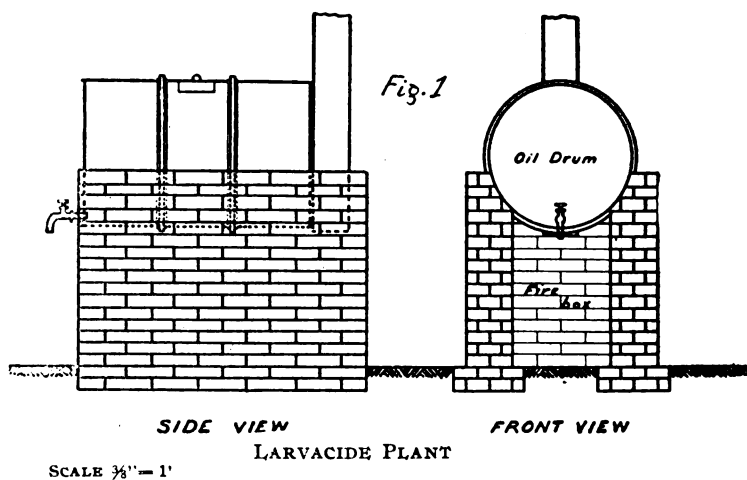
All pools or depressions which might become mosquito breederies or that can be filled at moderate cost, should be, and a porous substance such as ashes, sand or gravel used for this purpose. By filling we eliminate the cost of draining and oiling, and where filling is properly done there will be no future cost for maintenance. In Panama large areas were filled hydraulically, thereby reducing the oiling and drainage costs of the Sanitary Department. It is a subject requiring a great deal of skill and judgment and should not be lightly regarded.

Oiling.

Where it is not practicable to fill or drain, oiling should be resorted to, but only after the other methods have proved inadvisable, for unless oiling operations are carefully and diligently performed, they will be useless. In speaking in this sense I refer to large areas—small pools or containers are easily taken care of, though perhaps they are often neglected and cause much trouble. Crude petroleum has been used very extensively for oiling, with varying degrees of success. On the Canal Zone, and I may say, in the Tropics in general, its use has not proven very effective. The dense vegetation in the Tropics does not allow the oil to cover the whole surface of the water and larvæ will live in the grass and algæ along the edges of the pool. Sometimes the oil will sink to the bottom of the pool, leaving a

space on the surface of the water with no oil film. Another objection is that heavy rains will often wash the whole film away, and on large bodies of water where the wind has full sweep, the oil film will be blown to the opposite side of the pool. The best remedy for these evils is the use of larvacides. The larvacide used in Panama and Vera Cruz consisted of a preparation containing carbolic acid, powdered resin, and caustic soda. This larvacide goes a long way—it being commonly used in the proportion of 1 part larvacide to 5 parts water, and sprayed with pumps. This emulsion will kill *Anopheles* larvæ within five minutes after application, but it will also kill all animal life present, such as fish, etc. The use of fish as destroyers of mosquito larvæ is advocated in many places, but we did not get very good results with them in Panama or Vera Cruz, and could not depend upon them to rid a pool or stream of mosquito larvæ. It is my understanding that they are largely used in New Jersey and with very satisfactory results.

At Vera Cruz, Mexico, crude oil, direct from the wells at Tampico, was used for oiling (it being impossible to obtain fuel oil), with fairly satisfactory results. As is well known, this Mexican oil has an asphaltic base, and is very thick, consequently it will not spread well. We applied this oil with knapsack sprays, sprinkling cans, buckets, etc., and then spread it over the surface



of the water with brooms. This was a costly method and we set to work to find a substitute. A larvacide plant was constructed as shown in Fig. 1 with very little expense, which supplied plenty of larvacide for our needs. This plant consisted of an old oil drum, for a tank in which to mix the preparation, a four-foot piece of pipe for a smokestack, and about one hundred bricks for a furnace. The total cost of the whole plant was not over \$5.00. Such a plant might be constructed in the United States for about \$15.00. We were able to manufacture about 350 gallons of larvacide per day with this apparatus, though it was never necessary to make more than 75 gallons. To anyone wishing to manufacture and use this larvacide I would recommend the above apparatus as being cheap and effective. This larvacide is made as follows: Heat 150 gallons of crude carbohc acid (specific gravity not greater than 0.97) in a tank; dissolve 200 pounds of powdered rosin in the acid; and then add 30 pounds of caustic soda dissolved in 6 gallons of water. The mixture should be stirred while heated. This mixture will yield about $3\frac{1}{2}$ barrels of larvacide, and is ready for use in a very few minutes.

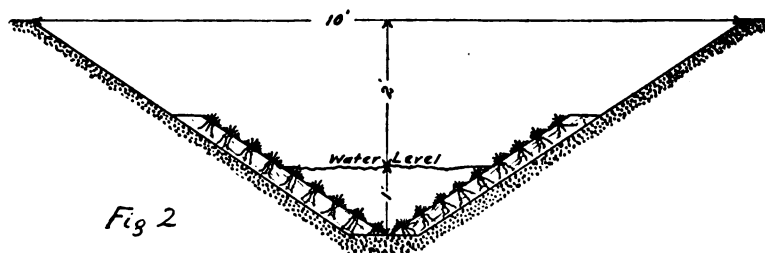
Drainage.

The types of ditches constructed for malarial-drainage work, or the destruction of mosquito breeding areas, are: open surface or earth drains, subsoil or tile drains, blind drains, and concrete drains. Of these four types the most common are open surface or earth drains; not because they are more efficient, but because they are the quickest and cheapest to construct.

Open Surface or Earth Drains.

Where conditions of soil are such that the slopes of an open ditch will stand and there is very little silting or growth of vegetation, and a sharp grade or run off, this is an economical form of construction, though not a wise one, for unless these conditions are ideal there will be a constant labor cost of maintaining the proper slopes, removing vegetation, and preserving proper grades. In constructing a system of this class care must be exercised in determining the proper slopes to be given in the character of soil at hand. Where the soil is sandy and loose there

should be at least a $2\frac{1}{2}$ or 3 to 1 side slope with a bottom width of not more than 1 foot. The depth and grade must of necessity depend upon the extent of the area to be drained and the length of the main trunk ditch. It is not wise or economical construction to have too many laterals or branches running into the main line, for there is danger of overloading; and also during a heavy rain there will be siltage at the junction of the branches with the main line. At Vera Cruz, Mexico, during the occupation by the American forces, it was found necessary to construct over 61 miles of open surface or earth drains. Practically all of this was done in loose, sandy soil and the cost of maintenance was very high, though labor was cheap. There was considerable seepage from the sand hills surrounding the city, and this, in conjunction with the heavy tropical rains, at times sent a terrific current through these ditches. Obviously this caused much siltage and the necessary cleaning and regrading of the ditches.



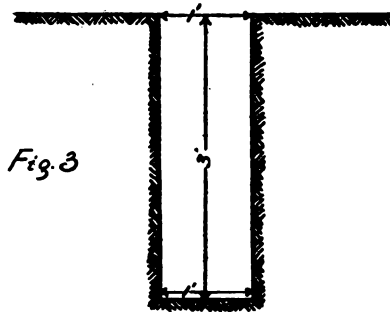
CROSS SECTION

EARTH DRAIN

SCALE $\frac{3}{8}" = 1'$

Many of the ditches, through constant cleaning and grading, had reached a depth of from 5 to 6 feet below their original depth. In places, where the current was exceptionally strong during a heavy rain, even with a slope of 3 to 1 the banks would not stand, and in order to correct this great difficulty an experiment was tried out with grass sod, which proved very successful. These sods were placed on the slopes of the ditch from the bottom to a height of two feet above normal water level, so that the current would not undermine the banks (See Fig. 2). This was tried out on a stretch of ditch 300 feet long, and although

the initial cost was fairly heavy, it paid for itself within two months, for where a gang of 30 men had been kept busy 6 days per month cleaning out this same stretch of ditch, after this sod lining was placed the banks held up and the swift current kept the ditch free from siltage, and the grass took firm hold in the sand banks, making the construction permanent. Again, in constructing open drains, care must be taken to eliminate, as far as possible, all curves or angles, for every one of such retards the flow of the stream and causes siltage. Laterals or branches should come into a main ditch running down stream, at an angle of not more than 45 degrees or on a slow curve. Where the soil is swampy and compact or held together by vegetation it is advisable to construct narrow ditches (see Fig. 3) about 8 inches or

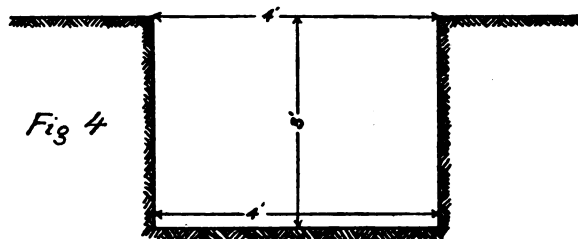


EARTH DRAIN

SCALE, $\frac{3}{8}$ " = 1'

1 foot wide, with perpendicular sides, and a depth sufficient to drain the area in question. The grade must be steep in order to provide rapid run off. Many miles of such ditches have been and are being constructed in the swamps of New Jersey. Such ditches were not found practicable in Panama or Vera Cruz owing to the loose character of the soil, and also because in the dry season large cracks would be formed by the drying up of the soil and the banks of such ditches would cave in, thus blocking up the drainage system. Such conditions prevailed at Corozal, Panama. When the soil would dry up in this manner large cracks would appear, sometimes 6 inches or more wide, which same places would be breeding areas after the first rain. In

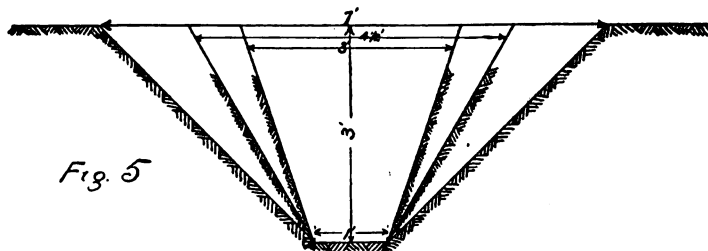
order to overcome this evil a drag was rigged up and hauled over the ground, filling up all such cracks.



EARTH DRAIN

SCALE, $\frac{3}{8}$ " = 1"

Open drains should never be constructed with wide bottoms (see Fig. 4), for unless constantly looked after, pockets will be formed along the banks, in which mosquitoes will breed, caused by driftwood, stones, etc., and the cost of maintenance will be very high. Then, too, they will not permit rapid run off, which is very essential from mosquito eradication standpoint. The best type of open drain is that shown in Fig. 5.



CROSS SECTION

EARTH DRAIN

SCALE $\frac{3}{8}$ " = 1'

Subsoil or Tile Drains.

Tile drains are perhaps the cheapest and best form of ditch construction, for they are not only cheap in their original cost, but if properly laid, the maintenance cost will be practically nothing (see Fig. 6).

To properly lay a tile drain the following must be done: First, the drainage system must be carefully thought over and

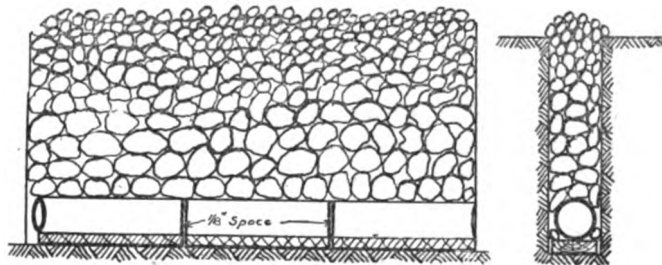


Fig 6 LONGITUDINAL SECTION CROSS SECTION
TILE DRAIN

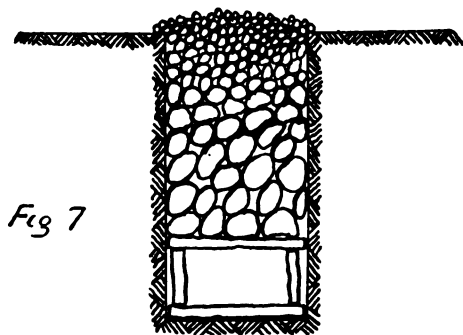
SCALE, $\frac{1}{8}'' = 1'$

planned, and lines and grades established; second, the ditch must be cut to grade (not less than 0.5 per cent.), having the bottom width slightly larger than the tile in order to facilitate the laying of the tile; third, before commencing to lay tile, all loose earth should be removed at least six feet from the open ditch, and eventually carted away, for if such is not done, after a few heavy rains some of this loose earth will make its way into the hollows between the stones, gradually filling up such spaces and eventually clogging up the tile drain; fourth, if the ground is of a hard substance, such as clay, the tile may be laid directly upon it, but if soft, it is better to wedge stones under the sides of the tile in order to give a firm foundation, but if the ground is very soft, short boards, the same length as the tile, should be laid first and the tile placed upon these, the ends of the boards corresponding with the end of each joint of tile; fifth, the space between joints of tile should not be more than one-eighth of an inch; sixth, having taken the above steps, large stones should be carefully placed upon the tile for a depth of at least eighteen inches, on top of this placing smaller stones, gradually reducing the size until they have been placed a few inches above the surface of the surrounding ground; seventh, extreme care must be taken that no loose earth has been allowed to fall between the stones, for this is one of the greatest faults in laying tile. On the Isthmus of Panama where tile drains were laid in sharply rising ground the grades were broken, allowing the water to come to the surface. Where such was done a wall of stone was constructed at the end of the line and the water allowed to fall to

a basin at a lower level, and thence into a second tile line. T's and Y's must be placed at intervals for laterals or branches. Properly placed tile drains are very successful and have been proved to be very effective on the Isthmus, where, during the rainy season, there is a great quantity of water to be taken care of in a short time, in order to prevent mosquito breeding.

Blind Drains.

A blind drain as shown in Fig. 7 consists of a narrow trench on the bottom and sides of which are placed flat stones. A cover stone is then placed over these, and upon this cover stone are piled stones to an elevation a few inches above the surface of the ground. The opening in such drains may be from six inches to one foot or more, depending upon the size of the stones at hand. LePrince says of this drain:



CROSS SECTION

BLIND DRAIN

SCALE. $\frac{3}{8}$ " = 1'

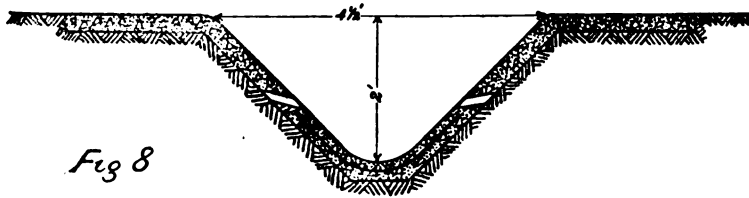
"Where plenty of stones are available and must be removed from a field, this form of ditch is economical to make and, in the Tropics, much more economical to maintain than an open ditch is, while *Anopheles* larvæ do not occur therein. * * * We opened some of these ditches when the flow of water in them became sluggish, but found no mosquito larvæ therein. The advantage of this type of drain is that there is no first cost for material, the field stones are disposed of, and there is not cost of maintenance except when the ditch clogs up. A good grade is essential for blind drains, and they will stand on a fairly heavy grade."

These drains were used to a large extent in Panama in the early days and were found to operate very successfully after a period of four or five years.

Concrete Drains.

Where sufficient funds are available and the desire is to construct neat, permanent and effective open drains, concrete is the ideal method.

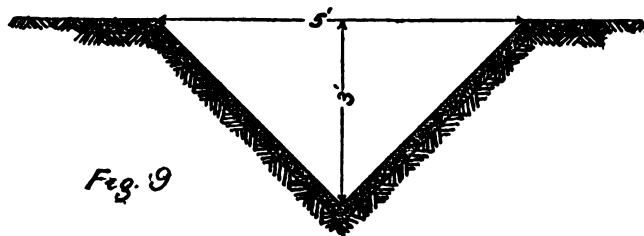
Concrete drains constructed as shown in Fig. 8 are an ideal type of surface drainage, for they are more efficient than earth drains, present a neat and clean appearance, are permanent in character, and their cost for maintenance is practically nil. One man with a sweep, made of a semi-circular piece of wood



CROSS SECTION
CONCRETE DRAIN

SCALE, $\frac{3}{8}$ " = 1'

slightly smaller than the bottom of the ditch, fastened to a long handle, can clean as much ditch in a day as he can walk over, and as rapidly. This, on the face of it, will readily show the cost of maintenance of this type of ditch as compared with open earth drains. Ditches of the type as shown in Fig. 8 were constructed in Panama wherever possible. As will be noted, the side slope is about 1 to 1, the bottom width being not over 1 foot and semi-circular in shape. The concrete is about $2\frac{1}{2}$ or 3 inches thick, reinforced at the bottom and part way up the sides with heavy chicken wire. The ditch is keyed to the banks with a beam about 1 foot in width. Numerous weep holes are placed in the sides above the reinforcing at intervals throughout the length of the ditch in order to catch the seepage water. The type of concrete ditches constructed in the South make ideal mosquito breederies. They are usually about 3 feet wide and from 1 to 3 feet deep, box shaped. As will readily be seen, this type of ditch presents a large area to be cleaned, and it is a very simple matter for loose stones, leaves, or driftwood to become caught and clog up the drain. One has but to walk along

*Fig. 9***CROSS SECTION****CONCRETE DRAIN**SCALE, $\frac{3}{8}$ " = 1'

a ditch of this type for a block or two and note the number of places where the ditch is blocked to pass judgment upon the efficiency of this type of drain. A V-shaped ditch, as shown in Fig. 9 is a better form of ditch than the above box-shaped one, though it is not as easily cleaned or as effective as that shown in Fig. 8, for the reason that often times stones and other matter will become wedged in the angle formed at the bottom and clog up the drain and cause much trouble and labor to the caretaker.

NOTES ON ANOPHELES PRODUCTION FROM A MALARIAL SURVEY.

By

H. R. CARTER,

Assistant Surgeon-General, U. S. P. H. S.

1. The Relation of Foul and of Clear Water to Breeding of Different Kinds of Mosquitoes.

There is nothing new in this observation, but it is a pretty illustration in nature of what we know so well and impressed the laity when it was shown them.

At Columbus, Georgia, there was a ravine running about 3 or $3\frac{1}{2}$ miles to the river. At the upper end it received a sewer. On the left side of it there were a number of small springs from 50 feet to 200 feet distant—9 of them within a mile and a quarter. These were all small and with their effluent streams made marshy places. Their water was clear and apparently clean. They were breeding *Anopheles* profusely, every one of them, up to the points of entrance into the stream in the ravine, which was very foul. Beyond these points *Anopheles* larvæ were not found. Almost at the sewer entrance *Culex* larvæ were found, and they were found in enormous number, so as positively to thicken the water, in the pools of this ravine for about one-half or three-quarters of a mile. They were found in lessening numbers, however, beyond this. No *Anopheles* larvæ were found in this polluted stream until about $1\frac{1}{4}$ mile below its origin, where the water was clear and without odor. A few showed here. A quarter of a mile below, the water meanwhile flowing broadly over grass, *Anopheles* were fairly abundant, with some, but a less number of, *Culex*, and this continued for nearly half a mile further, where another sewer entered. At this place *Anopheles* absolutely disappeared and *Culex* showed in large numbers down to the river, lessening somewhat as we went down.

Obviously, the stream, which was too foul for *Anopheles* in

the first part of its course, was diluted by the springs on its banks and purified by its course over stones and grass until it became suitable for breeding them. The water was clear and not offensive to smell where *Anopheles* larvæ were found.

The effect of the foulness of the water in favoring the breeding of a certain form of *Culex* was as marked as in opposing the breeding of *Anopheles*. To give an idea of their abundance: One small dipper at one dip secured enough pupæ to hatch 63 mosquitoes in one night. I confess I dipped for pupæ. All that I examined were *Culex pipiens*. The *Anopheles* were *A. quadrimaculatus* and *punctipennis*—the former mainly.

Also at Columbus, a beautiful clear branch comes out of the lake at Forest Lake Park. It runs, say, two miles and is breeding *Anopheles* freely and abundantly in side pools and eddies the whole way. Opposite Hamburger's Mill it receives the waste from the dyeing vats and all life in the stream disappears for some 500 or 600 feet. Here a large sewer enters and less than 15 feet below its mouth *Culex* appear and are found in very large numbers as we go down. No *Anopheles* are found below this. The water in which these *Culex* were breeding profusely was dark with dye.

I was informed that formalin was used "to set" the dye at this mill. Possibly then this was the agent which prevented any breeding in the stream above the entrance of the sewer and, being rendered inert by combination with some elements of the sewage, the stream becomes suitable for *Culex* larvæ below the sewer entrance.

At Elizabeth City and Fayetteville, N. C., streams receiving dye were free from mosquito larvæ of all sorts for long distances—over a mile—from the entrance of the dye. These streams were sluggish, however, not quick flowing like the one at Columbus, and received no sewage; nor do I know if the same mordant, formalin, was used.

2. *Anopheles punctipennis*. Note on Season and Districts of Breeding.

(A) *Season*.—In a survey made at Blewetts Falls, N. C., July 15 to 30, quite a number of mosquitoes—imagoes—were

taken in outhouses and tents near the power plant and some elsewhere. These were mainly *A. quadrimaculatus*, but with some *A. punctipennis*. The catch of larvæ and pupæ at this time was not systematically developed into imagos, each breeding district to itself, but enough were developed to show no preponderance of *punctipennis*—rather the reverse. No crucians were found.

Another survey was made September 15 to 30. In this the catch was systematically developed—each district to itself. The proportion of *punctipennis* to *quadrimaculatus* was roughly 2 to 1. It had been decidedly cold the first fifteen days in September and was disagreeably cold while we were there.

Another visit was paid, October 6 to October 15, when the weather was, I thought, too cold for *Anopheles* breeding, and was too cold, except in the sun, as no small larvæ were found in shaded pools and few even in the sun. Nearly the same field was gone over as on the last occasion. The catch of larvæ was systematically hatched out as before and gave the proportions of *A. punctipennis* to *A. quadrimaculatus* as about 5 to 1. One hundred and twenty-six imagos were developed in September and 190 in October.

This observation is not close enough, nor extensive enough, to justify a general deduction, but this result would be explicable if *A. punctipennis* developed later in the season—or in colder weather than *A. maculipennis*.

In this connection I would note that LePrince examined a district, October 21 to November 15, 1914, in which malaria had been extremely prevalent last summer and fall—one village giving a blood-index of over 32%. He found *Anopheles* larvæ in abundance, but of a very large number developed and of imagos captured *A. punctipennis* was almost exclusively the only form observed. In this district, then, either *A. punctipennis* must have been a very efficient malaria-vector—which is not in accordance with the general teaching—or some other form had been prevalent earlier in the season and had ceased breeding as the season advanced, while *A. punctipennis* had not. The latter may be the explanation.

Now that one suspects its possibility, it will be easy next

season to determine the proportionate effect on the breeding of the different species of *Anopheles* exerted by cold—or season. Howard notes that there is a decided difference in the nature of the breeding places of election of *A. quadrimaculatus* and *A. punctipennis*.

(B) *District*.—Greenville, S. C., is a large and widely scattered town in the upper part of the State, almost in the mountains. Two years ago—in 1912—it suffered from an extensive outbreak of malarial fever. Before and since that year it has been quite free from that disease—a few scattering cases only showing.

A stream running through the middle of the town was breeding *Anopheles* profusely last June, as were some other streams there. Fifty-nine imagos were captured here at that time and a few developed from pupæ. All except one were *A. punctipennis*; that one *A. crucians*.

Again, July 30 and 31, 151 *Anopheles* imagos were secured. All were *punctipennis*. The same streams were breeding profusely and all developed from the larvæ and pupæ thus secured—about 20 more—were *punctipennis*.

On October 7 and 8 another collection of 23 *Anopheles* imagos was made—22 *punctipennis* and 1 (male) *quadrimaculatus*. This determination was made by Howard, of the Bureau of Entomology, who also made the determination of the June catch.

Punctipennis was also the only form found in Rock Hill, another town in the up-country of South Carolina. It is fair to say, however, that our examination here was made only once—July 6 to 15, 1914—and under very unfavorable circumstances. It was after a deluge of rain and hail and the distribution of the imagos we secured was not representative of all parts of the town.

These were the only two distinctively upland towns examined in 1914. In both *Anopheles* were breeding profusely and in neither were any form except *punctipennis* found. In Greenville it is fair to say that in a sanitary sense only *A. punctipennis* was breeding. The examination at Rock Hill was not sufficient to justify this statement of it. That this form conveys malaria has not been accepted as proven, and certainly it does

not do so very readily. Some other form, then, should have been producing in Greenville in 1912.

It is a thing to be noted in future surveys: If *punctipennis* is the only or principal form of *Anopheles* found in the "up-country" of the South—about the upper limit of the malarial section—and hence this note.

3. Collections of Water Not Producing *Anopheles*, yet Showing *Anopheles* Larvæ.

The pond at Hartsville, S. C., is the only old pond we had a chance to study. By "old pond" I mean one that has practically ceased changing both physically and biologically. It is probably 20 to 30 years old. It is a fairly large pond, but not like the great ponds of the hydro-electric plants.

When first examined, in June, a considerable number of *Anopheles* larvæ were found near the banks. All were small—few over what we judged to be three days old. Evidently eggs were being deposited in the pond and were hatching, but either we had struck on a time just after a considerable oviposition—the first in some time—or else the water was not suitable for the production of *Anopheles* mosquitoes.

It was visited again, by LePrince, in early August and the condition of the pond found to be different in its upper and lower portion. The former was densely covered by "water-shield"—an aquatic plant—and among the floating roots of this plant adult—or nearly adult—larvæ were found in sufficient numbers to probably constitute "breeding" in a sanitary sense, although no pupæ were seen. Minnows, as in June, were abundant, and it was evidently the "fish control" which rendered the pond unfitted for the production of *Anopheles*. Obviously, larvæ might escape fish for a few days, especially when very small, and yet not be able to do so long enough to pupate.

Thinking that the growth of water-shield might increase as the summer went on, LePrince again visited this pond in early October, and found the same conditions: some adult larvæ, and probably production of imagos, in the upper pond. None in the lower. A very pretty illustration of an incomplete breeding place. The *Anopheles* most common about Hartsville was crucians.

With this may be grouped a small pond at Rock Hill belonging to the Arcade Mills. This pond seemed to be not at all suited for breeding *Anopheles*, yet to our surprise it showed a good number of them. Well, we thought our judgment of conditions was at fault. Here *were* larvæ, and many larvæ, and larvæ of all sizes, and we were mistaken. That was all. Four days later the pond was practically free from larvæ. They had, we found, been washed into the pond from a little marsh higher up the valley—which was breeding profusely. The conditions in the pond, dead algæ, etc., had killed the larvæ washed into it.

I group this with the Hartsville pond, because in both the conditions of the water were not suitable for the complete development of *Anopheles* larvæ introduced into it.

4. Complete and Incomplete Breeding Places.

It seems proper to call that place a complete breeding place in which the imago is developed from eggs deposited in that place. An incomplete breeding place is one in which something less than this occurs:

1. Places in which eggs are deposited, but either eggs, larvæ or pupæ perish there and the imago is not developed—as at the Hartsville pond.

2. Places in which eggs are deposited, but they, or the larvæ from them, are removed to some other place, (a) to develop there, or (b) perish: as when a stream is washed out by a freshet and the eggs and larvæ lodge elsewhere and develop or are destroyed.

3. Places in which larvæ are found, but hatched from eggs deposited elsewhere than in that place, i. e., which have been washed down as eggs or larvæ from places up stream and lodged. Such places are evidently the complement of (2) and if the larvæ undergo complete development into imagos in their new environment these two incomplete breeding places are equivalent to a complete one. This class frequently requires consideration in the study of the ponds of large power plants—as indeed does the first class also.

Would it be proper to call the above incomplete breeding places Class 1, Class 2 and Class 3 respectively? It would save time and words in referring to them.

AN EXPERIMENT WITH STOMOXYS CALCITRANS IN AN ATTEMPT TO TRANSMIT A FILARIA OF HORSES IN THE PHILIPPINES.

By

M. BRUIN MITZMAIN, M. D.,
U. S. P. H. S.

It has never been determined whether or not the stable fly can transmit microfilariæ through its bite. Although the development of certain of these parasites has been traced in the body of the fly, animal hosts have not been utilized in an effort to determine the practical rôle of the *Stomoxys*.

Investigations carried out at Ostia in Italy by Noe* tend to show that *Stomoxys calcitrans* is the intermediate host of *Filaria labiato-papillosa* of the ox. Noe's studies were not confirmed by experiment. It appeared that the embryos of the parasite passed through the walls of the alimentary canal of the fly and collected in the head whence the adult larva made its way into the labium of the *Stomoxys*.

I have observed during a veterinary experience of three years in the Philippines eight cases of parasitism by microfilariæ in draft animals. The parasites found were presumed to be of the same species. They were about 90 μ . in length with no evidence of a sheath. Dr. Hassall, to whom material was sent for determination, states that the blood parasites are *Microfilariæ*, species nearest to *M. sanguinus equi africano* described by Balfour in 1911 from the blood of an African horse.

In an epidemiological study of the Philippine infection mosquitoes were at first considered, but beyond obtaining negative results in many dissections of *Culex fatigans* no information was obtained.

Stomoxys calcitrans was considered in a more extensive study. The problem assumed was to investigate only the transmissibility

*G. Noe. "Studi sui cicli evolutivo della *Filaria labiato papillosa*." Atti della Reale Accademia Dei Lincei Anno CCC. Serie Quinta Vol. XII, 2 Semestre. Fasc. 9 pp. 387-393 (1903). Quoted from Austin, African Blood Sucking Flies, p. 148-149.

from animal host to animal and to treat the parasitism of the intermediate fly as a subsidiary factor. For this purpose there was presented an Arab stallion whose blood upon daily examination was found to be never free of active microfilariæ. Four Filipino horses which had escaped infection from attempts of experimental transmission with surra were taken for the normal contacts for the purpose in view. They were peculiarly suited for the test, as their blood had been previously examined every day for two months in a routine inspection for trypanosomes.

Two hundred flies of both sexes of *Stomoxys calcitrans* emerged July 28 and were placed in individual glass media tubes and permitted to dry and harden for one day. They were applied July 29 to the shaved skin of the Arab whose blood showed as many as 12 microfilariæ in a single field under the low power of the microscope. One hundred and ninety-seven flies fed when permitted to bite the horse. These were again applied the following day when 170 of the number engorged themselves with blood containing a moderate number of active microfilariæ. The flies were then kept without feeding until August 3, at which time a healthy animal, horse No. 339, was used to supply them blood; 154 flies were fed upon the normal horse. From this time the flies were applied daily during a period of 42 days to the four horses as indicated in the following table.

TABLE SHOWING THE APPLICATION OF FILARIA-FED STABLE FLIES UPON HEALTHY HORSES.

Date.	Animal Used.	No. Flies Fed.
August 3.....	Horse 339	154
4.....	Horse 339	144
5.....	Horse 339	144
6.....	Horse 123	131
7.....	Horse 123	116
8.....	Horse 123	97
9.....	Horse 344	84
10.....	Horse 344	74
11.....	Horse 344	73
12.....	Horse 344	65
13.....	Horse 344	65
14.....	Horse 344	62

15.....	Horse B	58
16.....	Horse B	54
17.....	Horse B	52
18.....	Horse B	49
19.....	Horse 339	47
20.....	Horse 339	47
21.....	Horse 339	42
22.....	Horse 339	38
23.....	Horse 123	34
24.....	Horse 123	29
25.....	Horse 123	29
26.....	Horse 123	28
27.....	Horse 123	27
28.....	Horse 123	25
29.....	Horse 123	22
30.....	Horse 123	19
31.....	Horse 123	16
Sept. 1.....	Horse 123	14
2.....	Horse 123	12
3.....	Horse 123	10
4.....	Horse 123	9
5.....	Horse 123	8
6.....	Horse 123	7
7.....	Horse 123	6
8.....	Horse 123	5
9.....	Horse 123	4
10.....	Horse 123	4

The four flies were killed and dissected September 10.

An effort was made to determine the effect of parasitizing the flies with the filaria infested blood. For this purpose a control series of 200 laboratory bred flies were applied to a healthy horse under the same conditions maintained for the flies of the parasitized series. The table following indicates the rate of death of the flies during the 42 days of application.

Days of fly feeding.....	1-10	10-20	20-30	30-42
Percentages of Death—				
a. Filaria fed flies.....	58	20	14	8
b. Control flies.....	25	30	16	29

It may be surmised from these results that the greatest death rate for the parasitized flies was during the first ten days or during the period when development of the microfilariae took place in the bodies of the flies. The remaining periods were marked by probable degeneration of the larval filaria so that

there was no discernible increase in deaths above normal. The larvæ apparently degenerated in the thoracic muscles without arriving at maturity. In five flies which were killed one or two days after the last feeding of infected blood a moderate number of microfilariae were seen in the gut contents in blood still apparently fresh.

The fate of the parasites in the gut of the fly may perhaps be indicated from one instance observed. A fly which was found in a feeble condition one day after feeding upon the infected horse was crushed on a slide, and its gut contents examined. A cover slip was dropped over a small portion of blood exuding from the mass. Attention was arrested by the unusual behavior of one of the microfilariae observed here. Instead of the ordinary lashing movement among the blood corpuscles, there appeared to be a simple lateral movement with almost pendulumlike rhythm on the part of the sinuous parasite.

Occasionally there was noted a slight translatory movement, but this was obviously retarded. It was observed then upon careful focusing that the microfilaria was attempting to escape destruction from a phagocyte. Nearly one-third of the parasite had already been devoured by a polymorphonuclear and was now rapidly becoming disintegrated chromatin particle by particle. The amœboid character of the leucocyte was indeed being forced to its utmost as fresh bits of filarial structure were actually engulfed in methodical progression. When almost half of the parasite was seen to be phagocytized in this piecemeal fashion the specimen was photographed as reproduced on Plate I. Here may be seen some granules of filarial material within the cell of the phagocyte, the parasite being photographed while slightly contorted in the act of struggling to free itself.

This phenomenon of phagocytosis is perhaps merely suggestive of one cause of the nondevelopment of a large percentage of the microfilariae ingested in the body of the biting fly.

From the fifth to the eighth day after imbibing infected blood 31 flies were dissected, but in only three of these were developmental forms of filaria observed. In these the larval worms were found embedded in the thoracic muscles. These were in appearance fibrous and rather translucent, measuring .75 mm. to .90



ILLUSTRATING ARTICLE OF DR. MITZMAIN
PHAGOCYTOSIS OF MICROFILARIA IN BLOOD OF HORSE OBSERVED IN STOMOXYS
CALCITRANS, MITZMAIN PHOTO.

20

mm. in length. After the eighth day the dissected flies gave no evidence of parasitism. The four flies killed and dissected after 42 days did not show parasites in any of the tissues sectioned. During the time the flies were not applied in feeding they were kept in the dark at a temperature of 26° to 28° C., in individual media tubes with a bit of filter paper.

During the entire period of the experiment the five horses were kept in individual stalls in a screened stable. The blood of the four healthy animals was examined two to three times weekly for sixty days after the final fly application. They were also examined a month later, when all appearances of blood infection were absent.

INTRAVENOUS MERCURIC CHLORID IN MALARIA.

Preliminary Report.

By

NATHAN BARLOW, M. D.,
Cuyamel, Honduras.

Throughout the entire South, both the rank and file of the profession and the laity are firmly convinced of the value of calomel in malaria, and in almost every locality some old practitioner will relate cases of chills and fever cured by calomel alone. The enormous amounts of calomel administered produce frequent salivation and permanent damage after results.

As the danger of such administration of calomel is well recognized by both the laity and the profession, it seemed to the writer incredible that the practice could have prevailed over so wide a territory and for so long a time, unless the belief in its efficiency had some foundation in fact. The idea was tested in the following case.

Case I. C. E., a very intelligent white mechanic, presented in August of 1913 with an infection of *P. falciparum* (of the type described by Craig¹ as tertian). The patient had an unusually marked idiosyncrasy for quinin. A few grains caused great nervous irritability, cardiac weakness, and collapse followed by an extensive urticaria. It was found impossible to accustom him to its use. Salvarsan, g. 0.6, was given intravenously. Great improvement followed; but the infection was not destroyed, and in April of 1914 the patient was having regular paroxysms and was approaching the stage of cachexia. As he was still unable to take quinin, it was determined to test the effect of calomel. He was given 2 grains every other night for two months. No symptoms of mercurialism were produced. A rapid improvement of symptoms and general condition resulted, and after one month no parasites were to be found in the blood. He was under observation for a period of six months, and remained free from symptoms. Careful examinations of the blood were made at intervals, and no plasmodia were found.

Owing to the slow and uncertain absorption of mercury when administered by ordinary methods, it is likely that only in rare instances can a sufficient concentration in the blood be obtained without danger of serious mercurial poisoning. It was therefore determined to study the effect of intravenous injection of the

bichlorid of mercury. An intelligent patient was selected, and the experiment conducted precisely as the previous experiments with quinin.² Slides were made at frequent intervals, both before and after the injection, and the effect upon the parasite observed.

Case II. F., D., native, age 24. Had suffered for nine days with typical malarial paroxysms occurring every other day. The blood showed a very heavy tertian infection, with but one brood of plasmodiæ. An intravenous injection of slightly less than one-fourth grain of mercuric chlorid was given at 10 a. m., the chill being due the same day at 4 p. m., the parasites varying from three-quarters grown to nearly developed schizonts, with numerous gametes. The paroxysm did not appear, but was replaced by a gentle fever beginning without a chill at 2 p. m., gradually rising to 101.6 at 5 p. m., and subsiding by lysis. With the exception of a single 5-grain capsule of quinin, taken previously and which had produced no appreciable effect either upon the fever or upon the blood picture, the patient had no other medication, either before or after the injection. There were no further symptoms of malaria.

Six weeks later, a series of blood specimens were taken at frequent intervals. There were no parasites found, and the differential leucocyte count was normal. The action upon the parasites was very interesting, and in marked contrast to that observed by the writer after the administration of quinin by the intravenous route.² The ameboid motion in fresh specimens was retarded by mercury, but was more active after quinin. The rate of growth, judged by comparison of successive stains, was made more slow or checked altogether by mercury, but was accelerated by quinin. Of the nearly developed schizonts, only a few proceeded to full development after mercury, while all did so after quinin. The entrance of the merozoites into the red cells was unaffected by the presence in the blood of 20 grains of quinin, no evidence of its occurrence was seen after mercury. The action of quinin was evident only upon the partly grown schizonts. Mercury was destructive to all forms. The gametes were not promptly affected by either; but entirely disappeared thirty hours after the mercury, while their complete disappearance after quinin occurred only after several days.

These differences were interpreted by the writer as confirming his previously stated conclusion that quinin acts indirectly, by decreasing the stability of the red blood cell, and as indicat-

ing that the action of mercury is direct and that it destroys the plasmodium both at the time of its liberation and during its existence in the red cell.

The case reported by Deppe³ should be mentioned. A parturient woman had a fever which resisted quinin for some time. She was given intravenous injections of rather small doses of mercuric chlorid on five successive days, with recovery. Owing to the fever having resisted quinin, and to the fact that a cure was brought about by the injections, it was assumed that the symptoms were due to sepsis, in spite of the fact that numerous subtertian rings were present only two days before the first injection. As no mention is made in the report of any further administration of quinin, and as the patient made a complete recovery, it seems possible that the intravenous medication is to be credited with the cure of the malarial infection as well as that of any septic condition present.

The writer regrets that his temporary cessation of active work has interrupted the experiments, and offers this preliminary report in the hope that other interested observers will determine if the prompt results and freedom from relapse shown in Case II can be obtained in a sufficient proportion of cases to make the method of value in a general anti-malarial campaign.

References.

1. Craig, C. F. Osler & McCrae: *Modern Medicine*. 1914. Vol II, p. 59.
2. Anti-malarial Campaign at Cuyamel. *Am. Jo. Trop. Dis. and P. M.* 1915. Vol. II, No. 9, 585-596.
3. Deppe, L. Intravenöse Sublimating. bei Trop. Mal. mit latender Sepsis. Beihefte 2. *Arch. f. Schiffs u. Tropenhyg.* 1914. XVIII, 41-79.

A POINT TO BE CONSIDERED IN UTILIZING THE DUCK AS A MOSQUITO DESTROYER.

By

F. C. BISHOPP,
Dallas, Texas.

L. W. Sambon¹ states that the larvæ and pupæ of mosquitoes are destroyed in great numbers by waterfowl.

K. Friedrichs² points out that ducks, like fish, keep pools and ponds free from mosquito larvæ.

Howard, Dyar, and Knab³ cite Beutenmuller's opinion that aquatic birds could be used for the purpose of destroying mosquito larvæ in rain barrels, ponds, and other waters near houses; also in well-cleared fields and cultivated land where there is no extent of woods. He is stated to think that the management of aquatic birds under such conditions can be made simple, and their breeding profitable. The same authors quote Mr. Wilton Lockwood, an artist of Boston, who had a fad for raising ducks, to the effect that in his opinion they are great destroyers of mosquito larvæ. Mr. Lockwood was impressed by the work of the spoonbill duck, which, in his opinion, is particularly adapted to the destruction of the mosquito larvæ resting at the surface of the water. The same authors quote W. L. McAtee, who lists in a circular of the Biological Survey, nine species of shore birds known to eat mosquitoes, and make the statement that Mr. McAtee has also found mosquitoes in the gizzard of the mallard duck.

In November, 1913, Dr. Gebbing,⁴ Director of the Zoological Garden at Leipsic, pointed out the desirability of protecting wild ducks in order that they may be utilized, as far as possible, as destroyers of mosquito larvæ. He also recorded instances where they had sufficiently cleared infested ponds of mosquitoes.

1. *Journal of Tropical Medicine*, September 15, 1902, p. 283.

2. *Fischerei-Zeitung*, June 16, 1912, v. 15. No. 24. See *Tropical Diseases Bul.* December 15, 1913, p. 654.

3. *The Mosquitoes of North and Central America and the West Indies*, v. 1, 1912, pp. 178-179.

4. *Eine neue Art der Mücken bekämpfung-Frankfurter Zeitung*, Frankfurt, November 25, 1913.

More recently Dr. H. G. Dickson,⁵ Commissioner of Health of Pennsylvania, has published some discussions along this line, citing an instance in which mallard ducks completely cleared out mosquitoes above dams across a stream.

There seems to be no doubt that ducks are of much value in destroying larvæ and pupæ of mosquitoes of many kinds. There is a point, however, in connection with the habits of ducks, particularly when kept rather closely confined, which under certain circumstances may somewhat detract from their value as mosquito destroyers. Where ducks are kept confined in yards in which the ground is rather moist they often dig holes to a considerable depth. I have observed some of these excavations from four to six inches deep with comparatively small openings at the surface. As a result of this habit yards are sometimes filled with numerous holes of this kind and when the ducks are removed to other yards or disposed of these holes remain and often form admirable breeding places for *Anophele* and other species of mosquitoes. The partial or complete covering of such holes with bermuda or other kinds of grass frequently makes them inconspicuous, or completely hides them, but does not prevent mosquito breeding. Two instances were observed by me where this condition prevailed. In these cases mosquitoes were causing considerable annoyance and investigation revealed the fact that these holes made by ducks were responsible for the breeding of the majority of the mosquitoes. No doubt while the ducks are confined in yards they prevent mosquitoes breeding in these holes which are frequently visited by them, but especially in towns where duck raising may be carried on temporarily as a fad or otherwise, the question of smoothing up yards where ducks have been kept should not be lost sight of. Those engaged in mosquito control work would also do well to keep these possible breeding places in mind.

5. The duck as a preventive of malaria and yellow fever. *Lancet*, v. 187, No. 4758, p. 1102, November 7, 1914.

NEWS AND COMMENT

Five members of a family were taken to Uvalde, Texas, on April 30, for treatment for Malta fever.

During April, 109 families in Pana, Illinois, were quarantined for measles and 13 families for smallpox.

The Randolph County, Georgia, board of commissioners has appropriated \$150,000 for hookworm work in that county.

The degree of LL. D. has been conferred on Dr. Rudolph Matas, of New Orleans, by Washington University, St. Louis.

The London School of Tropical Medicine continues its quarterly sessions despite the war. The average attendance has fallen to ten students.

We are informed of the change of address of Dr. Leonard Rogers from the Medical College, Calcutta, India, to 11 Elysium Rosa, Calcutta.

Bubonic plague is reported to be present in Constantinople and other parts of Turkey to an alarming extent and to be spreading rapidly.

Dr. R. H. Von Ezdorf, U. S. Marine Hospital, New Orleans, left on June 3 for Mobile to make a malarial survey of that part of the country.

Dr. John Dill Robertson has been appointed commissioner of health of Chicago by Mayor Thompson, to succeed Surgeon George B. Young, U. S. P. H. S.

Mr. Charles E. Fox, of the Maryland State Sanitary Engineering Department, has left for Serbia to assist in cleaning up the typhus plague spots for the Government.

Prof. W. T. Sedgwick organized a party of fourteen physicians, sanitary engineers and students from the Massachusetts Institute of Technology who left on May 15 for Serbia.

Dr. Samuel T. Darling is now at the Government House, Singapore, Straits Settlements. He has been sent by the Rockefeller Foundation to study tropical anemia and other diseases.

Colonel Alcock, arthropodologist of the London School of Tropical Medicine, has been appointed by the War Office chief medical officer in charge of Indian troops now in England.

May 16 was observed as health Sunday in Springfield, Illinois, when physicians attending the meeting of the State Medical Society filled the pulpits of many of the churches in the city.

Mr. George Hazelhurst, an expert engineer of Savannah, Georgia, has accepted a position with the Rockefeller Foundation. He will be sent to Serbia in connection with the work against typhus.

Dr. E. C. Rosenow, of the Memorial Institute for Infectious Diseases, Chicago, has been appointed one of the directors of the Mayo Foundation. He will also be chief of the department of bacteriologic research.

A large number of physicians in Havana, Cuba, have sent a great quantity of tobacco, cigarettes and "tabacos" to the French Red Cross. They also sent 164 bags of sugar, four bags of coffee, and rum and cash.

The United States Public Health Service has granted Dr. Richard H. Creel an indefinite leave of absence that he may become commissioner of health of Boston, but it is stated that Dr. Creel still declines the appointment, on account of ill-health.

Examinations for admission into the U. S. Public Health Service as assistant surgeon will be held on June 21 at the

Bureau of Public Health Service, Washington, and at the Marine Hospitals of New York, Boston, Chicago, St. Louis, Louisville, San Francisco and New Orleans.

Dr. Leiper, the helminthologist, Dr. Cochin, his assistant, and Dr. Thomson, the protozoologist, of the London School of Tropical Medicine, have been sent to Egypt by the War Office to study means of prevention of the spread of *Bilharzia* among British troops stationed in Egypt.

Mr. John D. Rockefeller, Jr., has presented \$16,500 to Johns Hopkins Hospital, to be used for a social hygiene department to be established in September. The committee in charge consists of Dr. George H. Walker, chairman; Dr. Theodore C. Janeway and Dr. Winford H. Smith, superintendent.

Assistant Surgeon General Henry R. Carter, sanitary expert and superintendent of the U. S. Marine Hospital in Baltimore, is in the South to engage in sanitation work in the malarial districts of Alabama, Georgia, and other Southern States. During his absence, Surgeon Charles W. Vogel will be in charge of the Marine Hospital in Baltimore.

Dr. Alvin J. Cox, director of the Bureau of Science, Manila, Philippine Islands, is in the United States for the purpose of getting in touch with laboratory men in this country and to establish a stronger coöperation between laboratory men, especially those interested in tropical medicine, and the men in the Philippine Islands.

The Shreveport, Louisiana, Board of Health passed an ordinance on May 29, designating pellagra as a communicable disease. Any house where pellagra exists must be placarded and the disease reported to the Board of Health. Children suffering from the disease are excluded from school, and pellagrins are prohibited from selling or preparing food or attending public meetings.

The Italian commission for the study of pellagra is carrying on investigations along the lines of the theory of the cause and treatment of pellagra advanced by Alessandrini and Scala. They attribute the disease to silica from drinking water and recommend trisodic citrate as the remedy. The pellagrins are being treated according to this method and the infected regions drained and watched carefully. The war may, however, cause a temporary lull in such activities.

Dr. Richard P. Strong, medical director of the American Sanitary Commission now working in Serbia, is appealing to the American people for assistance in the work of stopping the terrible ravages of disease in Serbia. Twenty-five more physicians and medical inspectors are needed, a quantity of cholera vaccine, ten large field automobiles and ten Ford motor trucks. A general appeal for 150 doctors, inspectors and fourth year medical students has also been issued by the Serbian Government.

An examination of private Jewish schools conducted in New York tenement districts was recently made and showed that conditions in most of them were deplorable. These schools are conducted in any available place—stables, tenements and lofts—and many of them are filthy, with no proper ventilating, lighting or toilet facilities. The investigating committee recommends that all such schools be required to register with the department of health and submit regularly to inspections by the health and fire departments.

Public Health Activity.

FLORIDA.—*Twenty-sixth Annual Report of the State Board of Health, 1914.* From this bulletin, full of pertinent suggestions and recommendations, we will mention only a few of the many topics discussed. The president of the board and the state health officer are in favor of a legislative appropriation to facilitate the purchasing and equipping of a health train similar to that of the Louisiana Board of Health. It is also thought highly desirable that the railway companies operating in Florida provide

the employees of the State Board of Health with passes. Traveling expenses are an item that detracts greatly from the budget. With a health train and also free transportation for board of health employees on any road in Florida, the work of the board could be spread into practically every part of Florida; the work would be much more thorough and comprehensive and more regular than is possible at present. Dr. Porter, the state health officer, speaks most feelingly upon the crime of not preventing preventable diseases. He does not think that an attack of smallpox is sufficient punishment for a man who has not protected himself against it, but says: "Rather should not such a perverse individual, after his physical punishment, be punished by law for being a common nuisance, a stigma on intelligence and a possible charge and money imposition on the public which his more provident neighbor must help to bear!"

OHIO.—*The Ohio Public Health Journal*, April, 1915. A Survey of Industrial Health-hazards and Occupational Diseases in Ohio, Part III, furnishes interesting reading for those who are concerned with industrial fatigue, its causes, results and prevention. Dr. Hayhurst sums up the chief factors which cause fatigue as follows: Laborious work, long hours, piece work, speeding up, monotony, constant standing, constant strain, chairs or stools without backs, faulty postures, jarring processes, pressing or holding objects against the body, eye strain, loud noises, irregular hours for sleep, and finally, the absence of work variation or periods of relaxation and recreation. Quite as serious as the fatigue caused by over-activity is that caused by inactivity. Persons with sedentary positions are really doubly poisoned by the poisons generated by fatigue and those gouty and other poisons caused by lack of ordinary exercise. There are, of course, many dangerous occupations and many that, by gases, heat, compressed air, etc., imperil life, but the foregoing conditions must be met in almost every factory and shop.

RHODE ISLAND.—*Quarterly Bulletin of the State Board of Health*, April, 1915. In this well gotten up bulletin there are a number of articles of more than passing interest, on bills before the Rhode Island General Assembly, child welfare, health

supervision of school children, the Montessori system, etc. Dr. John E. Donley contributes one entitled "Our Pathetic Faith in Pills"—a delightful little article combining a sense of humor with a very definite knowledge of human nature. The little child, who, however, suffers innocently, the young girl or man, the society woman, and the business man, all are victims of the habit of swallowing vast quantities of remedies supposed to be good for the ailment from which they think they are suffering. The necessity for this repair is, in the case of the business man, blamed on coffee, cigars, an ill-selected lunch, lack of exercise and worry. The business woman, Dr. Donley thinks, takes too little nourishing food and, for stimulation, wrecks her nervous system with tea. The three evils of the woman of leisure are candy, the automobile and bridge-whist. And so all classes and ages continue to live as is most enjoyable and convenient to them and attempt to correct their mistakes by "religiously swallowing pills."

TEXAS.—*Bulletin of the State Board of Health*, February, 1915. According to an article by Dr. C. H. Brownlee, since the beginning of the hookworm campaign in August, 1912, over 68,000 people have been examined in 48 counties in East Texas. Of this number 34,599 were school children, of whom 12,616 were infected. Through education, sanitation and treatment, this campaign is restoring thousands of lives that were being slowly sapped away. What would be the fate of these children and of the State if they remained untreated? Many would die and many more would grow into manhood and womanhood stunted and weakened both mentally and physically, unable to carry on properly the responsibilities of the rural communities and of the State. So the hookworm campaigns all over the South are not only relieving the suffering of her people, but are restoring to the South her rightful inheritance.

CURRENT LITERATURE

THE DANGER OF CARRIERS AND CHRONIC ELIMINATORS OF BACILLI ON BOARD SHIP. (*Die Gefahr der Bazillenträger und Dauerausscheider an Bord.*) (Continuation of article by A. E. Pannenburg, Bremerhaven. *Archiv für Schiffs- und Tropen-Hygiene*, Bd. 19, Nr. 2, 1915.) This concluding article treats of the prevalence of carriers and the spread of disease both on the ship and on the land of cholera, typhus, epidemic spinal meningitis, the plague, and diphtheria. Prophylaxis and disinfection measures are considered and the author's conclusions are:

1. That carriers are a constant and great danger on board ship for passengers and crew, more so than on land on account of the proximity of individuals.
2. As prerequisite for combating the evil is the establishment of identity of an individual as a carrier. This can be done alone on the ship and by the ship's surgeon.
3. Every ship should carry the microscope and bacteriological equipment necessary.
4. Isolation, especially of cholera and plague carriers.
5. Carriers among the crew are more dangerous than among passengers, especially among stewards, and should the condition be established among the latter, they should be withdrawn from service and placed under control.
6. Carriers on ships making long voyages should be interned at the next available land hospital.
7. Any of the crew desiring to ship after having been so interned should be required to present a certificate of freedom from infection.
8. The cost should be regulated by the state.
9. After it has been established that the carriers are on board, the ship's surgeon should employ all means to carry out strict disinfection measures.
10. The carriers which for any reason cannot be isolated should receive instructions and warning.

11. There should be placed receptacles containing disinfectant for sputa, in convenient places about the ship; they should be compelled to use a special privy and their wash water vessels and bath arrangements sterilized daily.

12. After leaving the vessel, disinfection of rooms used by carriers.

13. In case no ship doctor is carried, the captain and officers should receive instruction which should cover an understanding of the possibility of unknowingly carrying great danger to their fellow-men. The captain should be provided with printed instructions for use in cases suspected.

14. A steam sterilizer for the disinfection of garments and beds, and a formalin apparatus for room disinfection should be installed in all ships.

15. Antisera for at least diphtheria and typhoid should be carried in sufficient quantity on board.

L. C. Scott.

A SIMPLE PREVENTIVE REMEDY AGAINST LICE. (*Ein einfaches Vorbeugungsmittel gegen Verlausung und deren Folgen.*) (A. Eysell, *Archiv für Schiffs-und Tropen-Hygiene*, Bd. 19, Heft 6, 1915.) It has been a matter of observation that persons working around sulphur mines have been singularly immune to malaria and are not bothered by vermin. This is due to the absorption of minute quantities of sulphur and the exhalation through the pores in the form of hydrogen sulphide. This is unpleasant to lice, bedbugs, mosquitoes, etc., and hence they avoid the person. The remedy, especially directed toward lice, fleas, and bedbugs, is the rubbing of flowers of sulphur into the mesh of woolen underclothing and then wearing that side next the skin. In due time the action of the sweat and excreted products on the sulphur will produce the desired effect. L. C. S.

PREVENTION OF TYPHUS (TYPHUS EXANTHEMATICUS) AND LOUSE EXTERMINATION. (*Zur Frage der Bekämpfung des Fleckfiebers und der Läuse.*) (Prof. Dr. C. Mense, *Ibid.*) Typhus exanthematicus has become a scourge in the great war detention camps of Germany and especially those containing prisoners from the Russian army. The work of Prof. S. v. Prowazek in

these camps has cost that celebrated protozoologist his life. The means for prevention and eradication of the disease consist in the immediate disinfection of the clothes of the individual, either with steam or formalin or even with dry heat; when nothing else is available by going over the seams of the clothing with a hot iron and a candle, smearing on mercury or salicylic ointment. All persons in contact with typhus patients must observe the strictest rules of cleanliness, must be clothed in washable outer clothes, use overshoes and rubber gloves. The sleeves and legs of the trousers should be tied tightly to prevent the lice or fleas from getting into the body. After the day's work, a bath is taken. It has been found that many of the strong odored essential oils prove of value in doing away with vermin. The nits of the lice can only be destroyed by disinfection in steam or in carbon disulphide disinfectors. In the case of head lice and with nits, the old treatment with vinegar and mercuric chlorid, in the proportions of acetum vini 200 to hydrargyrum bichloratum 1.0, should prove effective.

L. C. S.

FACTORS RELATIVE TO THE APPEARANCE AND SPREAD OF THE THREE-DAY FEVER IN EAST SICILY AND LOWER CALABRIA. (*Ueber den Werdegang des Auftretens und der Verbreitung des dreitägigen Fiebers in Ostsizilien sowie in Unterkalabrien.*) (Prof. Dr. U. Gabbi, *Ibid.*) The earthquake disturbances which ruined the greater part of Messina and Sicilian and lower Calabrian towns in 1908 produced great masses of debris, which acted in conjunction with the bad sanitation as breeding places for the *Phlebotomus pappatacci*. The question of the origin of the fly is solved when the places for transshipments of wood used in the provisional structures is considered. These were principally Dalmatia, Herzegovina, and Istria, where the fly is prevalent and the disease endemic. Another theory is that the disease came through infected individuals along with cargos. It is a well-known fact that the flies secrete themselves among wood and are carried considerable distances. Moreover, it has also been demonstrated in the present epidemic that persons could carry the disease for considerable distances. Epidemics were violent during the years 1910, 1911 and 1912 in Messina, and here it was especially clear that they followed directly in the path of fly increase.

The decrease in the cases occurred with the clearing off of the virus and obliteration of defective latrines. It is accordingly advisable to replace wood barracks with ones built of stone, and to avoid open and defective latrines. The economic loss, according to the writer, approximates two million lire (\$400,000) in the whole of the affected areas of Calabria and Sicily.

L. C. S.

PYOSIS CORLETTI IN BRITISH SOLDIERS.—Chalmers and O'Connor (*Jour. Trop. Med.*, 1915, XVIII, 73) report a small epidemic of a bullous eruption, which occurred in an English regiment in Khartoum recently. They discuss the subject of bullous eruptions extensively. The fluid from the bullæ contains a gram positive diplococcus and a vaccin made from this organism gave good therapeutic results.

John M. Swan.

BRIEF NOTE ON A CASE OF TRIPLE INFECTION: TYPHOID, PARATYPHOID A AND PARATYPHOID B.—Castellani (*Jour. Trop. Med.*, 1915, XVIII, 37) reports the case of an American traveler, who suffered from a simultaneous infection with *Bacillus typhosus*, *Bacillus paratyphosus A* and *Bacillus paratyphosus B*. The patient's blood serum agglutinated all three organisms, on six different occasions. The agglutination was complete in a dilution of 1 in 80 for *B. typhosus*, 1 in 60 for *Bacillus paratyphosus A*, and 1 in 80 for *Bacillus paratyphosus B*. Absorption tests carried out twice, showed agglutination of all the organisms to be specific. The bacteriological examination of the feces showed all three organisms before a hemorrhage; but after the hemorrhage only *Bacillus typhosus* and *Bacillus paratyphosus A* were grown. *Bacillus typhosus* and *Bacillus paratyphosus A* were isolated from the urine twice.

J. M. S.

INTRACORPUSCULAR BODIES IN GUINEA PIG'S BLOOD AND YELLOW FEVER.—Seidelin (*Jour. Trop. Med.*, 1915, XVIII, 38) replies to the criticism of his work made by Wenyon and Low and abstracted in this *Journal*, 1915, II, 548.

J. M. S.

NOTE ON A VIBRIO (VIBRIO KEGALLENSIS CAST., 1913) ISOLATED FROM CASES OF PARACHOLERA.—Castellani (*Jour. Trop. Med.*, 1915, XVIII, 85) isolated from two cases of clinically

choleralike disease, and from the water of a well near which several cases had occurred, a vibrio which is biologically different from the true *V. cholerae*. In a preliminary note, published some time ago, referring to the first case alone, he named it *V. kegalensis* Cast., 1913. Though its pathogenicity has not been completely proved, the probabilities are that it is the cause of certain cases of choleralike disease, or "paracholera."

John M. Swan.

SPINAL ANALGESIA IN NATIVE PRACTICE.—Massey (*Jour. Trop. Med.*, 1915, XVIII, 87) has been employing spinal analgesia with stovaine for all operations below the umbilicus for three years. In native hospital practice it is the best method of anesthesia for such operations. It is of great value on the morale of the patient. He uses $\frac{3}{4}$ gr. of stovaine for an adult.

J. M. S.

AN ATTEMPT TO COLONIZE "MILLIONS" IN THE MALAY PENINSULA, FOR ANTI-MALARIAL PURPOSES.—Strickland (*Jour. Trop. Med.*, 1915, XVIII, 88) describes the attempt of the Government of the Federated Malay States to colonize "millions" in the waters of that part of the world for the purpose of destroying mosquito larvæ. The experiment has been partly successful.

J. M. S.

THE METEOROLOGY OF MALARIA.—O'Connell (*Jour. Trop. Med.*, XVIII, 97) extends his writings concerning atmospheric conditions and malaria by comparing observations made at Culebra, Canal Zone, with those made in the spinning and weaving sheds in Lancashire and Ireland.

J. M. S.

ATROPHODERMIA BIOTRIPTACI IN NATIVES IN THE ANGLO-EGYPTIAN SUDAN.—Chalmers and Drew (*Jour. Trop. Med.*, XVIII, 99) point out that in some natives of the Anglo-Egyptian Sudan the skin on the legs presents a peculiar atrophic appearance. The skin is shrunken; has lost its natural lines; has become distinctly darker in color; and presents whitish lines, which indicate the cracking of the superficial epidermis to form white scales. They believe this process to be pathological and not physiological, because it does not occur in every old person; it occurs in

only limited areas of skin in any one case; and it may occur in people who are not old, but in whom the affected areas of the skin has been exposed to the weather. Microscopically, the affected skin shows a thinning of the epidermis; decrease in size and an increase in the granulations of the cells of the stratum granulosum; thinning of the stratum malpighia, with an increase of pigmentation of the cells, and a thinning of the stratum corneum. In the corium the pars papillaris is less developed than it should be and the vessels are more dilated than normal. In the pars reticularis the small vessels and lymphatics are dilated and the connective tissue corpuscles and bundles are diminished in number; but there is no sign of inflammation nor any granular or hyaline degeneration. In the subcutaneous tissue the sweat glands are still present, but the adipose tissue and the hair have disappeared.

J. M. S.

PUBLICATIONS RECEIVED

Under this Department all titles received will be acknowledged and those considered by the Editors as of special interest to the readers of this JOURNAL will be reviewed.

BOOK REVIEW

MANUAL OF PERSONAL HYGIENE. By Walter L. Pyle. Sixth edition, revised and enlarged. W. B. Saunders Company, Philadelphia and London, 1915.

This standard text on hygiene is made up of individual chapters on varied topics, written by different authors, as Hygiene of the Digestive Apparatus, by Dr. Chas. G. Stockton; Hygiene of the Skin and Appendages, by George Howard Fox; Hygiene of the Vocal and Respiratory Apparatus, by E. Fletcher Ingalls; Hygiene of the Ear, by B. Alex. Randall; Hygiene of the Eye, by Walter L. Pyle; Hygiene of the Brain and Nervous System, by J. W. Courtney; Physical Exercise, by G. W. Stewart; Body Posture, by Joel E. Goldthwait; Domestic Hygiene, by D. H. Bagly; Food Adulteration and Deterioration, by Harvey W. Wiley; the Hygiene of Infancy, and a miscellany of various topics conclude the book. Each chapter is well written, but it does seem a little anomalous that so important an organ as the skin should be scantily treated and dismissed in some forty pages, while there are almost one hundred pages devoted to the eye, incidentally making almost one-fourth of the whole book, the rest being filled with all other questions concerned. This criticism is naturally relative and does not detract from the value of this particular chapter, which is written by the editor himself. The two chapters on Physical Exercise and on body posture are of exceptional value, the latter being elaborately illustrated and strongly presented. The authority of the various contributors, all earnest exponents of their particular fields, must establish the character of the book, while the contents will continually justify the compilation, which has been accomplished with a view to a modern presentation of the subject engaged.

Isadore Dyer.

REPRINTS.

BISHOP, ERNEST S. An Analysis of Narcotic Drug Addiction. *New York Medical Journal*, February 27, 1915.

GREIG, MAJOR E. D. On the Simultaneous Occurrence of Cholera and Cholerlike Vibrios in the Tissues in Cases of Cholera. *Indian Journal of Medical Research*, Vol. II, No. 2, October, 1914.

GREIG, MAJOR E. D. The Hæmolytic Action of Indian Strains of Cholera and Choleralike Vibrios. *Indian Journal of Medical Research*, Vol. II, No. 2, October, 1914.

HAFFKINE, W. M. On Prophylactic Inoculation against Plague and Pneumonia. Superintendent of Government Printing, Calcutta, 1914.

HECK, W. H. The Health of School Children. Contributions from American Medical Journals, July, 1913, to July, 1914. U. S. Bureau of Education, Bulletin, 1915, No. 4, Whole Number 628.

PERDUE, E. M. Pellagra: Its Etiology, Pathogenesis and Treatment. *American Journal of Clinical Medicine*, March, 1915.

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